JANUARY-1946

LE CONTROLLE Confracting

THE MAGAZINE OF ELECTRICAL CONSTRUCTION & MAINTENANCE



N THIS ISSUE . . . Forecasting '46, a round-up

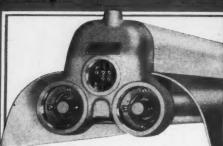
market trends . . . electrical reconversion in the auto industry . . . how farm electrification ... safety in welding ... analyzing overhead ... lighting techniques for food stores.

MARVEL OF SIMPLICITY

Skilful Design Cuts Costs in New, Exclusive ...



Approved for All Class I, Groups C and B Class II, Groups E, F and



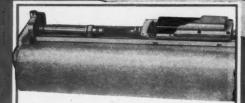
LINE CONNECTION IS EASY

End view with explosion-proof screw covers removed. Connecting block in upper hole simplifies installation. No other connections are made on the job. Lower holes show easily accessible starters, which can be replaced without removing lamps.



RE-LAMP IN A JIFFY

Takes two 40-watt,
48-inch, T-12 lamps,
supported by wire cradles
in tightly-sealed explosion-proof
Pyrex tubes. Cradles seat lamps easily
at far end. Special tool furnished for
engaging electrodes in handling lamps.



BALLAST QUICKLY ACCESSIBLE

Mounted in explosion-proof housing at center of unit, under outer dust cover. Easily reached when replacement is necessary. Flexible coupling relieves any possible strain on Pyrex tubes. Highly-efficient, baked white enamel reflectors easily removed for washing.

Explosion-Proof

FLUORESCENT FIXTURE

Simple, low-cost installation and quick, easy maintenance are part of the design of the new Appleton Explosion-Proof Fluorescent Lighting Fixture. They're built-in!

Now, oil refineries, chemical plants, hospital operating rooms, grain elevators and other hazardous locations may have the advantage of fluorescent lighting. Allowing for the fact that all wiring must be tightly enclosed to guard against explosion, every operation in installation and maintenance is as simple as with ordinary fluorescent equipment. Additional

maintenance cost is no factor.

Skilful Appleton engineering, so marked in this recent Appleton achievement, is common to all Appleton products—"Unilets," both regular and explosion-proof; lighting fixtures; conduit fittings; outlet and switch boxes. All of the thousands of types are carefully designed to install easily, to stand up on the job, to give maximum low-cost service.

Look carefully at the illustrations above, they'll tell you, plainly, why Appleton Explosion-Proof Fluorescent Lighting Fixtures should be in every hazardous location in your community—

why it's wise, on every job, to specify Appleton equipment —"STANDARD FOR BETTER WIRING!"

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APPLETON ELECTRIC COMPANY 1704 WELLINGTON AVE. • CHICAGO 13, ILLINOIS

Branch Offices: NEW YORK, 76 Ninth Ave. • DETROIT, 7310
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APPLETON

Electrical Contracting

With Which if continued to rate Effecting is and Electrical Record . Testablished tool

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A practical team cal and management journal for electrical contractors, interior engineers and motor so, covering engineering and management, in the field of electrical construction and maintetance.

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Easy Lies the Head the THE ACCURACY OF "ON AND OFF" LIGHTING TIME.....







FORM KAZ

- —ALWAYS TIMELY SELLERS

 —ALWAYS PROFITABLE
 - * FOR UTILITY LIGHTING
 - * FOR ADVERTISING DISPLAYS
 - * FOR PROTECTION

SANGAMO TIME SWITCHES never forget—that is why men who invest in lighting are easily sold on this "on and off" time accuracy. They are quick to see the advantage of eliminating a lighting worry and having AUTOMATIC CONTROL.

The sale of SANGAMO TIME SWITCHES means good profit for you—sell an installation with every lighting job which calls for automatic control—sell present users of lighting who do not have this AUTOMATIC CONTROL for their utility lighting—their advertising lighting, or for their protective lighting installations.

See our catalog for complete details—write for your copy now.

FORM KAZ—SYNCHRONOUS MOTORS SILVER CONTACTS

Six levers are provided for a maximum of 3 daily "on" and "off" operations. Accurate timing is obtained by turning the minute hand reset staff, on the 24 hour dial. If desired the time-switch can be manually operated without affecting subsequent operations. Available in a wide variety of combinations providing two-circuits, duplex, and outdoor switches; also with Sunday and holiday omitting device, as well as advance time cutoff. The KAZ Astronomic Dial Time-Switch functions to close the circuit at sunset and open it at sunrise, or the "off" operation may be set at any time between 9:30 P. M. and 2:15 A. M.

FORM VSWZ— SYNCHRONOUS MOTOR WITH CARRYOVER

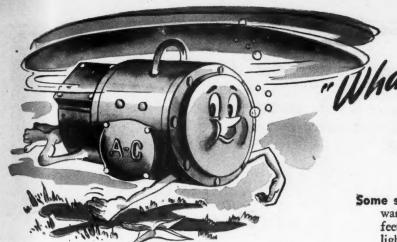
Synchronous timing is combined with reserve spring clock operation, providing continuous operation during current interruptions up to ten hours. This entirely automatic carry-over eliminates the necessity of resetting the dial after current interruptions, and insures accurate timing under all conditions. Also equipped with Astrohomic Dial.



FORM VSWZ

ASTRONOMIC DIALS: Both of the Sangamo Time Switches shown here are equipped with Astronomic Dials. These dials enable "on" and "off" operations in accordance with sunset and sunrise.

SANGAMO ELECTRIC COMPANY SPRINGFIELD



Some said "Impossible!" Rut of Some Said "Impossible!" Rut of Said "Im

Some said "Impossible!" But the Navy insisted, "We want a motor that likes water so well it'll run in 25 feet of it for 90 days. What's more—it's got to be lighter, more compact than standard motors."





No diving suits allowed! Biggest problem was waterproof, pressure-proof casings. Cast-iron wouldn't do — too porous. So we turned to fabricated steel tough, durable — and lightweight too!

Then we found that fabricated parts could be successfully welded together to assure water-tightness. For proper magnetic characteristics, we decided to use field yokes of one-inch rolled steel.



Things look better! We reinforced end-housings, doublechecked insulation, made sure exposed parts were leak-proof. Nothing left to do but put our baby in the test-tank, check it regularly, and hold our breath.

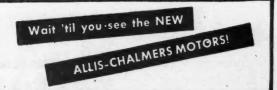


90 days later—we took a good look. Motor still running and not a drop of water inside! That called for a short cheer and wide smiles all around. Mass production of these motors followed,



46

There's a Moral: Every time Allis-Chalmers engineering solves special motor problems, we discover new ways to build better standard motors for you. Allis-Chalmers, Milwaukee 1, Wis.



HEAR THE BOSTON SYMPHONY: Every Saturday Evening, American Broadcasting Co.



Ouick and easy does it with this tough little steel-and-malleable ratchet die stock—heattreated toolsteel dies, precision cut and factory tested, give you smooth perfect threads. Die heads snap in from either side, can't fall out. No special dies are needed for close-to-wall threads. External ratchet No. 00R for ⅓" to 1" pipe, No. 111R for ⅓" to 1¼"—internal ratchet No. 0R for ⅓" to 1," No. 11R for ⅓" to 1¼." For durable efficient work-saver threaders... ask your Supply House for PIEDIDS.



Pick up a PIEDID by the powerful comfort-grip I-beam handle and it feels like an unusually efficient wrench. It is. The precision-cut alloy jaws grip pipe firmly, let go instantly. Adjusting nut spins easily in all sizes, won't bind. You like the handy pipe scale on the full-floating hookjaw, the replaceable heeljaw. And the guaranteed housing assures you long

RIBBID Strap Wrench.

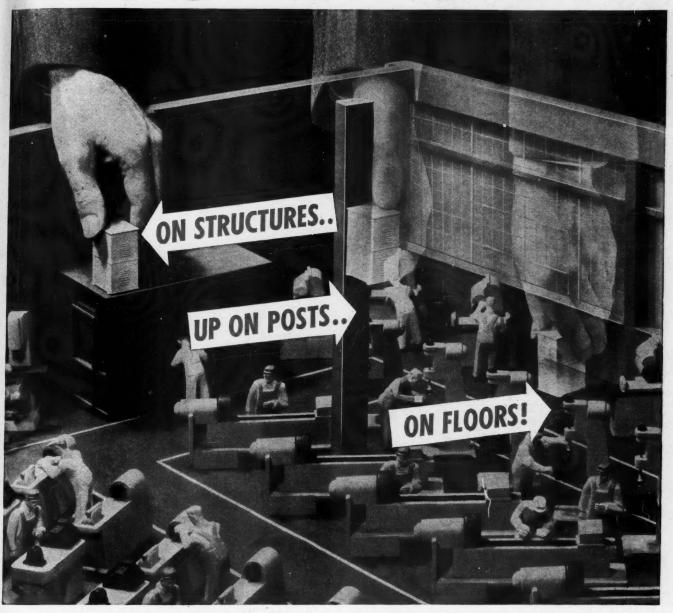
expense-free service — most for your money. Ask your Supply House.

Millions of RIDOID
Tools in use

RIBRID

The Ridge Tool Company Elyria, Ohio, U. S. A.

They go in Anywhere!



Yes, FLEXIBLE Allis-Chalmers Dry Type Transformers can be installed right at load centers — next to the equipment they serve! Because they're small, light-weight, won't drip, you can put them anywhere ... on floors, up overhead, or right on machines.

But, even more important, Allis-Chalmers Dry-Type Transformers actually *step-up* motor and lighting performance...help *increase* plant productiveness! They

make your work easier and save you money at the same time. Here's why:

1) They eliminate long, costly runs of heavy secondary copper. 2) Require little or no maintenance — because they're dry-type...have nothing to leak, no liquids to test, filter or change, 3) They cut down installation costs...require no fireproof vaults.

Hundreds of electrical men have proven that it's smart buying to specify these modern, adaptable units in their work. If you're not one of them, why not get more facts today! Send for Bulletin B6027. Allis-Chalmers, Milwaukee 1, Wis.

Hear The Boston Symphony: Every Saturday Evening, American Broadcasting Co.

A 1839

ALLIS & CHALMERS

ise!

by All-bright

THE LOUVRED RU-1002 FLUORESCENT FIXTURE

Soft, Cool, "SKYLIGHT" effect Illumination

25255555

- Achieves 10 to 20 more foot candle.
 Offers concentrated,
- glare-free illumination!

Custom-Built!

Our Research Department has designed this fixture for "easier seeing." Perfectly patterned louvred bottom offers greater concentrated efficiency. Linex Satinol glass. Flush or suspension mounting . . . individual or continuous rows.

NOW Ready...

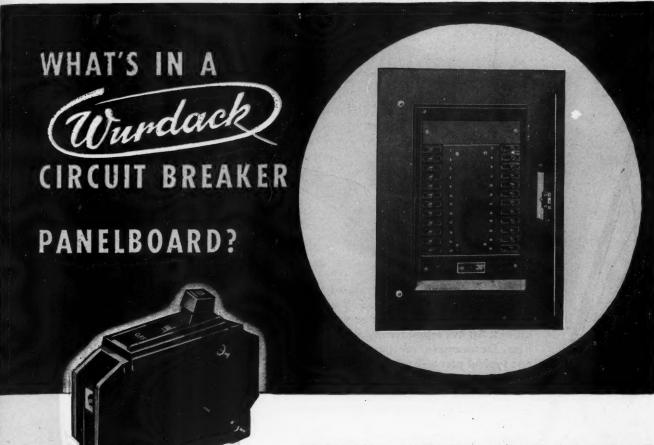
The ultra in recessed fluorescent fixtures that offer unhampered lighting beauty. Features a sturdy, telescopic frame that fits snug to the most uneven ceiling. Special piano hinged and "quick-slide" catches for easy, simple maintenance. Available with egg crate or honey-combed louvre. Individual or continuous rows.





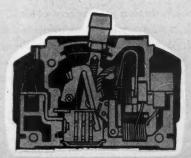
ALL-BRIGHT ELECTRIC PRODUCTS COMPANY

Manufacturers of Fluorescent Lighting Fixtures
3917 N. Kedzie Ave. Chicago 18, Illinois



The Quicklag Breakers, the nerve centers of the Wurdack Circuit Breaker Panels, give instantaneous action on short circuits and overloads—breaks short circuits as great as 5,000 amperes in 1/240 second! Yet the breaker is not oversensitive to minor power surges and harmless temporary conditions.

Wurdack "Quicklag" Breakers have thermal-magnetic action, embodying the deionizing principle in arch quenching. Inverse time limit overload, 15 to 50 amperes. Single and double pole.



UNFAILING, CONSTANT CIRCUIT PROTECTION PLUS FLEXIBILITY AND EASE OF INSTALLATION

Just as you're putting your sincere best into the wiring and conduit—be sure it leads up to the best in safety, efficiency and long life in your circuit breaker panel-board installation. Wurdack puts in its BEST in a circuit breaker panel just as you put in your best in the whole installation.

In Wurdack Circuit Breaker Panelboards you have the right capacity and protection to fit the job. Compact and flexible, Wurdack Circuit Breaker Panels are available in standard and in column types for greatest efficiency in limited space.

Write now and reserve your copy of the new Wurdack Circuit Breaker Catalog.



WM. WURDACK ELECTRIC MFG. CO.

4444 CLAYTON AVENUE

SAINT LOUIS 10, MO.

THE RIGHT AT THE RIGHT.

It's surprising how many places there are around a factory where close voltage regulation can improve processes or working conditions. All five regulator installations shown here, for example, are paying their way at one typical plant—probably similar to yours in many of its operations.

In planning more efficient electrical usage, be sure the right voltage is right where you

want it. General Electric's full line of feeder voltage regulators—large and small—manual and automatic—can meet any problem where volts or kilovolts must "toe the line". And your local G-E office can deliver whatever technical aid you need to apply them to the job. Apparatus Dept., General Electric Co., Schenectady 5, N. Y.

These dry-type induction voltage regulators are used to control temperature of a wire-annealing operation. Twelve strands are processed simultaneously, each regulator acting to control the current-flow through series-connected sections of two conductors. These hand-operated regulators make it easy to adjust for different conductor sizes and other changes in operating conditions.





2 Smooth, stepless voltage control for 100,000-volt testing equipment is provided by this 5-kva dry-type induction voltage regulator. Connected in the primary (low-voltage) side of the step-up transformer, this regulator affords 100 per cent raise-and-lower regulation, so that output test voltage can be varied from 0 to 100 kv, simply by turning the crank.

.. PAYS OFF 5 WAYS AT A SINGLE PLANT

USING G-E VOLTAGE REGULATORS

Electric heating circuits on a hot-rolling press used to fabricate laminated plastic forms are maintained at the required temperature with induction voltage regulators. Circuits for two electrically heated rollers and one hot plate are separately controlled by the hand-operated regulators, giving close control of processing.

eder

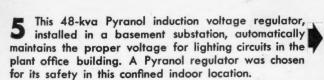
an-

lem ne". hatn to Co.,

le 0



Automatic voltage regulation by means of this drytype induction regulator has "paid off" in a more uniform level of illumination. The full visual value of every kw-hr is obtained with fewer lamp burn-outs from overvoltage. Production space is saved by locating the regulator on a platform along with the Pyranol* transformer which serves the lighting circuits.



For complete information on any of General Electric's voltage regulation equipment, write for the following publications:

Oll-immersed Induction Voltage Regulators—Type IRS GEA-2018 (24 kva and smaller) GEA-2985 (36 kva and larger)

Pyranol Induction Voltage Regulators—Type IRS, GEA-3443 Dry-type Induction Voltage Regulators—Type AIRS, GEA-3057 inductrols (Small Dry-type Induction Voltage Regulators)
GEP-238

Automatic Voltage Stabilizers GEA-3634 Variable-voltage Autotransformers GEA-3635



*Trade-mark for General Elec-

GENERAL ELECTRIC





Natvar Varnished Fiberglas is available in 36" width rolls and sheets, or cut to any desired tape width.

ATVAR Varnished Fiberglas is used primarily to insulate equipment which must operate at temperatures above the safe working range of other insulating materials. It is approved Class B insulation.

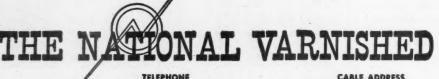
But there are actually three advantages. For, in addition to its superior heat resistance, Natvar Varnished Fiberglas has excellent mechanical and dielectric strength, because it is carefully processed with special varnish to take fullest advantage of the Fiberglas base.

Write, wire, or phone us for quick deliveries, either from nearby wholesaler's stock or from our own.



- Varnished cambric straight cut and blas
- Varnished cable tape
- Varnished canvas
- Varnished duck
- Varnished cellulose acetate
- Varnished special rayon
- Varnished Fiberglas cloth
- Varnished papers
- Varnished tubings and sleeving
- Varnished identification markers
- Lacquered tubings and sleevings
- Extruded vinyl tubing
- Extruded vinyl identification markers

Write for Catalog No. 20



TELEPHONE RAHWAY 7-2171 CABLE ADDRESS
NATVAR: RAHWAY, N. J.

PRODUCTS Corporation

205 RANDOLPH AVENUE

*

WOODBRIDGE NEW

1-NVP-

CROUSE-HINDS

Panelboards and Distribution Centers



Type YSW Vaportight and Weatherproof Condulet with Four Circuit Breakers

The illustrations show a representative selection from the dozens of different CROUSE-HINDS Panelboards—each designed for its own purpose.



Type DVS Dust-Tight Vaportight and Weatherproof Condulet with Two Circuit Breakers

No. 6 of a series of advertisements which demonof a series of advertisements which demon-strate that CROUSE-HINDS "complete line" means much more than just a range. of sizes—there is a wide variety of highly specialized types in each classification.



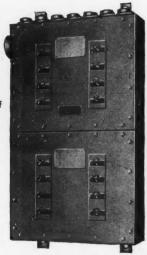
Type GUSC Explosion Proof. Dust-Tight and Weatherproof Condulet with Two Circuit Breakers



Type ESP Explosion-Proof, Dust-Tight, Vaportight and Weatherproof Panelboard with Four Circuit Breakers



Type DVS Dust-Tight portight and Weatherproof Condulet with Six Circuit Breakers



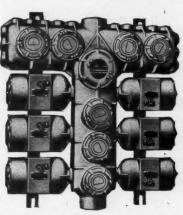
Type DVP Dust-Tight and Vaportight Panelboard with Sixteen Circuit Breakers



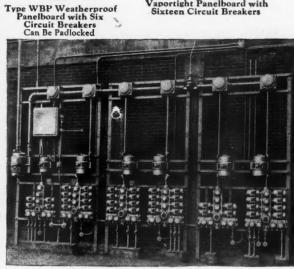
Type GUSC Explosion Proof. Dust-Tight and Weatherproof Condulet with Four Circuit Breakers



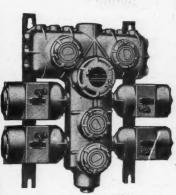
Type DVP Dust-Tight and Vaportight Panelboar with Eight Circuit Breaker



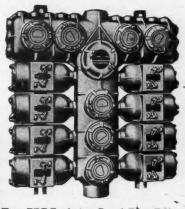
Type EDP Explosion-Proof, Dust-Tight, Vaportight and Weatherproof Panelboard with Six Circuit Breakers



Explosion-Proof Distribution Center



Type EDP Explosion-Proof, Dust-Tight, Vaportight and Weatherproof Panelboard with Four Circuit Breakers



Type EDP Explosion-Proof, Dust-Tight, Vaportight and Weatherproof Panelboard with Sixteen Circuit Breakers



CROUSE-HINDS COMPANY Syracuse 1, N. Y., U.S.A.

Ollices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Kansas City — Los Angeles — Milwaukee — Minneapolis New York — Philadelphia — Pittsburgh — San Francisco — Seattle — St. Louis — Washington. Resident Product Engineers: Albany — Atlanta — Charlotte CROUSE-HINDS COMPANY OF CANADA, LTD., Main Office and Plant: TORONTO, ONT.

CONDULETS . TRAFFIC SIGNALS . AIRPORT LIGHTING . FLOODLIGHTS





Tell me, Precious, WHO'S DIS RACO Guy?

- It's the dependable line, the uniform line; it's the famous name of All-Steel-Equip's quality line of steel switch boxes and outlet boxes. Builders, contractors, and architects the country over know that they can always rely on Raco . . . and here's why:
 - Smooth, attractive appearance. No jagged or rough edges no dirt or grease. Raco products can be installed with pride.
 - Every Raco product comes in protective carton, with index showing number, quantity, and finish. Easy to stock, identify, and inventory.
 - All-Steel has been making precision metal products for over 33 years.
 The Raco line is made to the same exacting standards.

Write today. Let us tell you more about Raco • All-Steel • Products — the line that's sold nationally by wholesalers only.



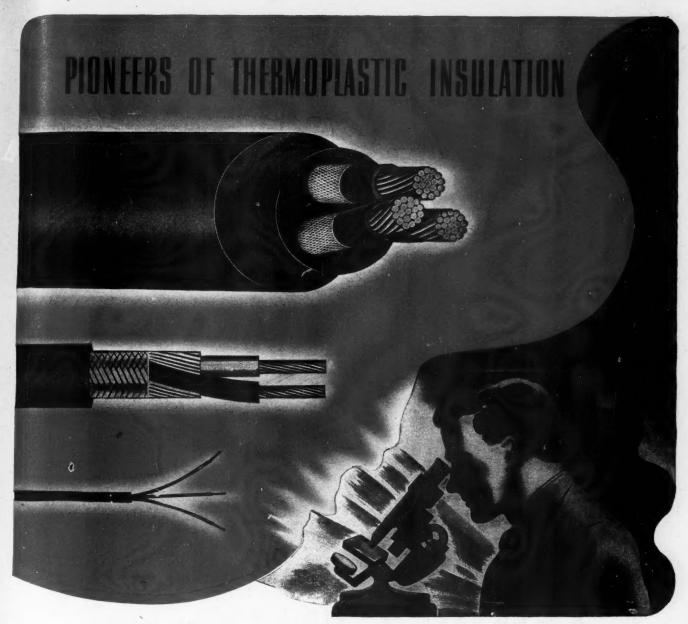
←400½-O-STANDARD (UTILITY) BOX. With "Side-Mount" Bracket. Enameled or galvanized finish.

400½-B—STANDARD (UTILITY) BOX. With "Face-Mount" Bracket. Enameled of galvanized finish.→

ALL-STEEL-EQUIP COMPANY, INC. 600 Kensington Avenue, Aurora, Illinois



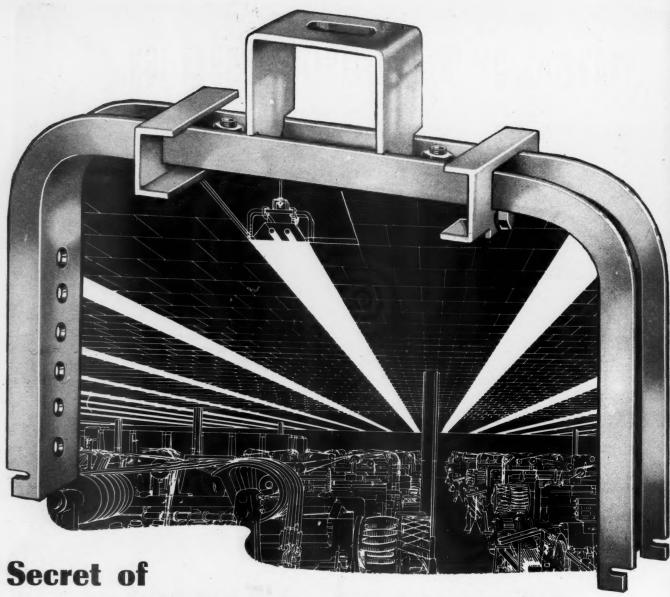
RACO · ALL-STEEL · PRODUCTS
SWITCH BOXES · OUTLET BOXES



Thermoplastic insulation specialists . . . producing a complete line from fine wires to heavy power cables . . . serving: Public Utilities, Radio, Electronic, Appliance and Instrument Manufacturers, Telephone Companies and Contractors.

There are few, if any, other fields in which thermoplastics are solving more problems . . . or accomplishing more fundamental changes in industrial design . . . than in the insulation of wire and cable. Demand today the increased resistance which these new compounds and constructions offer to heat, flame, oxidation, chemical action, oil, grease, moisture, cold, abrasion, fungus growth and other severe conditions. Write NOW for complete information and samples engineered to your particular requirements. Remember . . . when you're thinking of PLASTIC you're thinking of US!

PLASTIC WIRE & CABLENORWICH CONN CORPORATION



CEILINGS UNLIMITED

... the patented Miller Ceiling Furring Hanger for any type furred ceiling

Exclusively Miller's, this ingenious hanger licks many old construction problems—without creating new ones. It is the "can do" behind today's trend of planning interiors around the lighting.

No more laborious fitting of recessed lighting into hung ceilings. Instead, simply hang Miller Ceiling Furring Hangers from the structural ceiling—and hang furring, tile and Troffer Lighting System from the hangers!

Less than half the usual supports are needed. This means savings—as well as more "above-ceiling space" for piping and air conditioning ducts. Savings in wire, wiring and conduit costs are also substantial. Quick leveling means are provided.

But that's just the beginning! The whole fascinating story is told in CEILINGS UNLIMITED. Miller engineers and distributors are in principal cities.

THE MILLER COMPANY . MERIDEN, CONNECTICUT

Fluorescent, Incandescent
Mercury Lighting Equipment

HEATING PRODUCTS DIVISION

Domestic Oil Burners

and Liquid Fuel Devices

ROLLING MILL DIVISION

Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION War Materiel FOUNDRY DIVISION Non-Ferrous Metal Castings









AMERTRAN

DRY-TYPE **TRANSFORMERS**

a Natural for Plant Distribution

The Pantasote Company's Passaic, N. J., plant is replacing a combination D.C.-A.C. system with an all A.C. system. Continuity of service during the changeover was a problem. Three AmerTran 37.5 KVA Dry Type Transformers were installed. At present these AmerTrans supply part of the lighting load, also 80 HP 3 phase 240 V. A.C. for power purposes. Eventually the AmerTrans will take the entire plant lighting load.

AMERICAN TRANSFORMER COMPANY 178 Emmet Street Newark 5, New Jersey

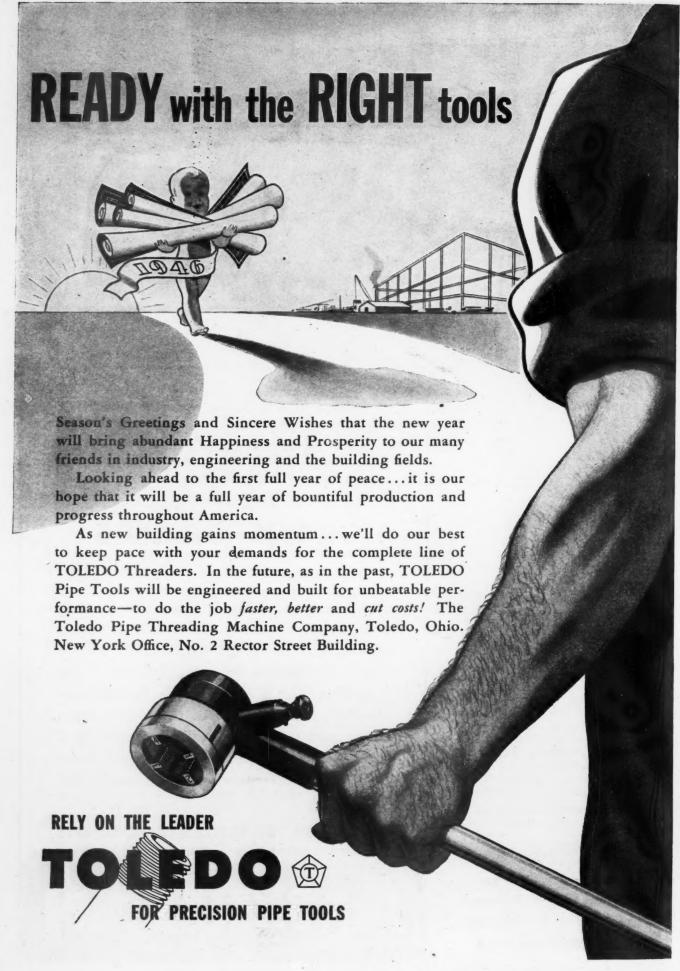




Compact and durable. Installed, indoors or outdoors, out of the way - in corners, on pillars, shelves, beams, ceilings—at load centers. Wide variety of ratings.

No maintenance; no piping; no liquid. Safe, clean efficient.

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission



JOLEGO'S SLIMLINE FLUORESCENTS ARE AVAILABLE Now!

OMERICAN

More than 300 footcandles of illumination bring prospective buyers to store front of American Sporting Goods Company—a huge show window attracting passers by with appealing light.



Illumination in the fourth floor General Offices averages better than 50 footcandles to increase efficiency, and provide unsurpassed working comfort for employees.

Here is tomorrow's lighting today—sleek

Adding arguments in cress to display — othering "eye and buy" comfort for both customer and sales personnel — combining the utmost in light utilization with smart appearance — Joleco's Slimline Fluorescents are providing truly modern illumination for selling in St. Louis' most up-to-date store—American Sporting Goods Company.

Considering every factor—quantity and quality of light—adaptability to the job—modern beauty in harmony with any architectural theme—reasonable cost—economical maintenance—easy installation—plus others to meet your specific requirements—Joleco-Slimline Fluorescents offer outstanding advantages and value in light for both seeing and sales.

Learn more about Joleco's New Slimline Fluorescents and how they can help solve <u>your</u> lighting problems. <u>Write today for catalog pages that will be ready soon.</u>



The ample soft, glareless light of Joleco Slimline Fluorescents in President Marold Sieben's office help simplify the problems of directing this aggressive, ultra-modern merchandising organization.

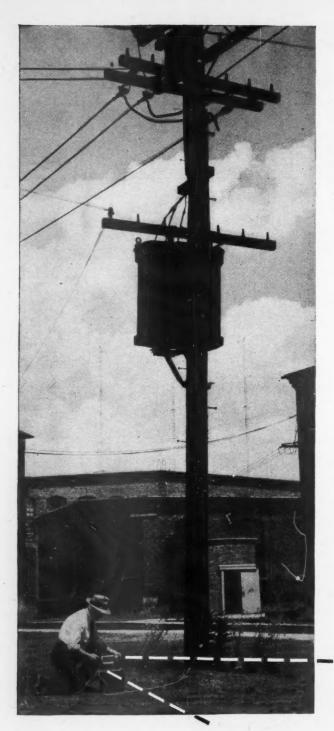
Interiors by Design, Inc., St. Louis



In the first floor main selling area, Joleco Slimline Fluorescents bring more than 70 foot-candles of light to the merchandise level. Above and below the mezzanine 50 foot-candles is maintained. Showcase fluorescents by Joleco increase selling effectiveness.

FLUORESCHALL STRONG OF STR

On the second floor where boats and large items are sold, surface-mounted Slimline Fluorescents maintain nearly 50 footcandles of light. In the third floor sport apparel department, sales are made under nearly 60 footcandles of light.



Are you getting protection from your ground connections?

• Ground connections that are improperly installed or have dried out; contacts that have become corroded and loose; exposed metal parts that may become "live" when they should be grounded—all of these can cause trouble when lightning strikes or fault currents develop—can cause injury or death to personnel and material damage to operating equipment.

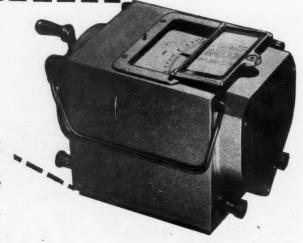
Know the condition of all your man-made grounds through the periodic use of a "Megger" Ground Tester. These well-known and widely-adopted instruments measure resistance to earth of ground connections, quickly, easily and accurately. Since 1927 they have come into extensive use by power companies, railroads, industrial plants, telephone and telegraph companies everywhere . . . Supplied in both "Megger" and "Meg" types, in various ranges from 0-3 to 0-30,000 ohms.

Order now for your Spring ground testing program.

For a full description of the "Megger" Ground Testers, including the principle of operation, write for Catalog EC.

Some important and valuable features of the "MEGGER" GROUND TESTER

- Has its own hand generator; requires no batteries or other external power supply.
- 2. Direct-reading in ohms—"like a voltmeter."
- 3. No calculations.
- 4. Only one set of connections.
- 5. No adjustments or "balancing."
- 6. Unaffected by the exact resistance of the reference grounds.
- Unaffected by stray current in the earth either a-c or d-c, or by polarization or electrolysis.
- 8. Covers a wide range of resistance —0-3 up to 0-30,000 ohms.
- Self-contained, rugged and portable.
- 10. Represents only a small fraction of the cost of adequate grounding protection.



*T. M. Reg. U. S. Pat. Off.

JAMES G. BIDDLE CO. 1211-13 Arch Street · Philadelphia 7, Penna.

IT'S GROWING EVERY DAY, THE

HOLDENLINE CHAN'L-RUN



See your wholesaler or write direct for Bulletin B-45

HOLDENLINE COMPANY

fluorescent marks the dra-

matic new fixture designs

soon to be announced.

Pioneers in Fluorescent

1960 EAST 57TH STREET . CLEVELAND 3, OHIO

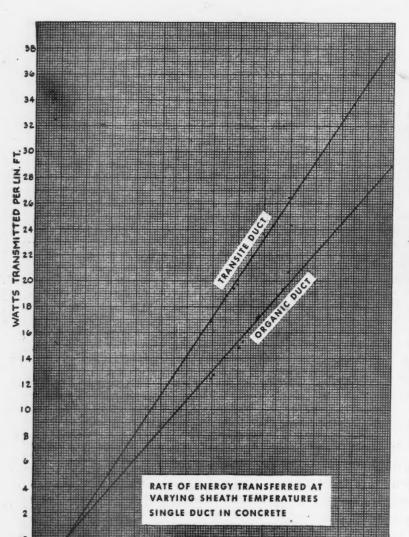
bet for tomorrow!

waste, in plants all over America. New efficiencies and

economies in the CHAN'L-RUN line make it a still better

Gooler Gables

proved in the laboratory and in operation with Transite Ducts



S THE GRAPH shows, Transite Ducts made of asbestos and cement have a much higher rate of heat transfer than organic conduit. Tests in the Johns-Manville Laboratories, later applied to specific field conditions, proved that Transite Ducts dissipate I2R losses 13% faster than other ductways tested, thus keeping cables cooler.

In actual operation, this means that cables installed in Transite Ducts have a higher inherent load capacity, or, carrying rated loads, will run cooler, thereby reducing copper losses and increasing cable insulation life.

Transite Ducts, made of asbestos and cement, are strong, immune to rust and rot. They are incombustible and unaffected by electrolysis or galvanic action. A permanently smooth bore makes possible long cable pulls and easy replacements. Long, lightweight lengths can be quickly and economically installed. In addition, a variety of fittings simplifies even the most complicated

For full information write for Data Book DS-410: Johns-Manville, 22 East 40th Street, New York 16, N. Y.

The chart shows why Transite Ducts keep cables cooler than ordinary organic ducts.

Johns-Manville TRANSITE DUCTS CONDUIT for use without concrete KORDUCT for concreting in



NON-DETERIORATING

EASE OF APPLICATION

GOOD Adhesion

DIELECTRIC STRENGTH

> HIGH TENSILE

PROTECTIVE PACKING

EASY TEAR-OFF

TRADE ACCEPTANCE ACCURATE
TAPES
have many extra features



...they stand up!

ACCURATE calendar-process friction tapes enjoy nationwide trade acceptance. They speed installation and maintenance . . . assure consistent repeat sales. Their non-raveling, supersticking qualities make possible a faster, neater job. ACCURATE tapes offer durable, dependable coverage and protection for temporary or permanent requirements.

ACCURATE rubber tapes enjoy wide popularity wherever they are sold. These strong, high elasticity tapes have excellent sticking qualities that insure fast economical installation. All ACCURATE TAPES are carefully wrapped and attractively packaged. Backed by over 25 years' experience, they are profitable items for wholesale distribution. Inquiries are invited.

ACCURATE MFG. COMPANY

A QUARTER CENTURY OF TAPE SPECIALIZATION

44 HEPWORTH PLACE • GARFIELD • NEW JERSEY



Build a Successful Industrial Lighting Department



Industry is lighting-conscious. Thousands of plants are a ready market for modern MITCHELL lighting. With the complete MITCHELL line, you can render a thorough lighting service... and get the business! Selling is easier because you bring your customers these positive benefits:

(1) Top lighting efficiency (2) Simpler installation (3) Lowercost maintenance (4) Rugged durability (5) Wide choice of models. Back of you at all times are MITCHELL resources, advanced engineering ideas, certified quality, and strong selling aids. All this gives you a definite edge on competition. All this helps you build a successful industrial lighting department.

Makers of

Industrial and Commercial Fluorescent Lighting Equipment
Store Window Lighting • Spotlights and Floodlights
Desk Lamps • Portable Floor and Table Lamps
Bed Lamps • Ultraviolet and Infrared Health Lamps
Residential Lighting Specialties



Mitchell Manufacturing Company 2525 CLYBOURN AVENUE, CHICAGO 14, ILLINOIS

West Coast Factory and Sales Office: 1019 N. Madison Ave , Los Angeles 27, Cal.

MITCHELL

Write for full-size Catalog No. 281 and packetsize Catalog No. 290. Each tells full story of Industrial units . . . each builds soles

MITCHELL
FOR TOP LIGHTING VALUE

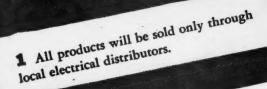
NOW ...



O.Z.

DISTRIBUTORS
CARRY COMPLETE
STOCKS!

The new three point O.Z. Distribution
Plan makes more Q.Z. Products man
available to you, through more distribution to bloom is in-



- 2 These distributors, located in principal cities throughout the United States, will carry large stocks of standard O.Z. electrical products—for immediate delivery.
- 3 Not only O.Z. Products, but also the consulting, designing and engineering service of the O.Z. Company will be more readily available to you, through the coperation of your nearby distributor.

⊕ 281



"They're OK if they're O.Z."

OZ.

MANUFACTURING COMPANY

262 BOND STREET . BR

BROOKLYN, 2 N. Y.

CONDUIT FITTINGS . CABLE TERMINATORS . CAST IRON BOXES . SOLDERLESS CONNECTORS . GROUNDING DEVICES . POWER CONNECTORS

Electrical Contracting, January 1946

25

REAL Protection

PLANT modernization brings opportunity to replace unsafe, temporary wiring methods and materials with approved time-tested systems.

You can now use standard-threaded, full-weight rigid steel electrical conduit wherever real protection is needed—for strength and endurance, for prevention of penetration of moisture, vapors and dust, for effective resistance to shock, vibration, corrosion, arcing and short circuiting.

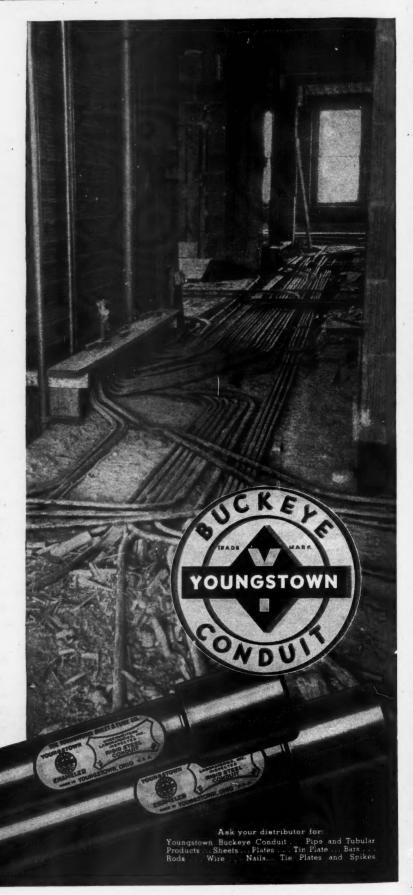
The most widely used standard—threaded full-weight rigid steel conduit is Youngstown's BUCKEYE. Your distributor has BUCKEYE CONDUIT in stock again—in the sizes and quantities you need.

THE YOUNGSTOWN SHEET AND TUBE COMPANY

YOUNGSTOWN 1, OHIO

Manufacturers of CARBON, ALLOY AND YOLOY STEELS

Right-This upper floor remained unfinished for several years. The rigid steel conduit afforded vital protection to wiring, against careless workmen and intruders.



TRUMBULL combination starters

THE NATIONAL ELECTRICAL CODE

NO. 4409 IN SIGHT OF CONTROLLER

The disconnecting means shall be located within sight of the controller or arranged to be locked in the open position.



Size 1. C.M. Magnetic Starter (7½ H.P.) and Fusible Motor Circuit Disconnect.



Size 3. C.M. Magnetic Starter (50 H.P.) and Non-Fusible Motor Circuit Disconnect.

You're always Right IF YOU USE COMBINATIONS

To comply with Code requirements there's no better way than to combine both magnetic starter and motor circuit disconnect in a single cabinet ... as illustrated by the three types of Trumbull Combination Starters here shown: Fusible, Non-Fusible and Circuit Breaker disconnect.

When starters are fed from individual circuit the No-fuse may be indicated; when short circuit protection at the starter is desirable, employ either Fusible or Circuit Breaker types. In any event, Combinations far surpass separate units in convenience, space saving and maintenance. They're completely wired to reduce mounting and wiring time.

The Trumbull name plate on your starter indicates mechanical and electrical efficiency of the highest degree. It means that the "pioneer builder of enclosed switches" has included all the essential features required for long, safe operation and full protection against overload, undervoltage and danger due to phase failure. Sizes 0, 1, 2 and 3–2 to 50 H.P. in all capacities needed for normal machine operation. Remote or local control . . . push-buttons as desired.

Specify TRUMBULL COMBINATION MAGNETIC STARTERS...and be RIGHT



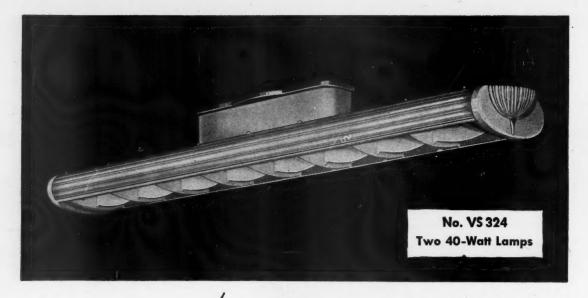
Size 2. C.M. Magnetic Starter (25 H.P.) and Circuit Breaker Disconnect.

THE TRUMBULL ELECTRIC MANUFACTURING CO.

PLAINVILLE, CONNECTICUT

OTHER FACTORIES AT

NORWOOD, OHIO - LOS ANGELES - SAN FRANCISCO - SEATTLE



VIRDEN

Fluorescent

by

John C. Virden Co.

CLEVELAND, OHIO

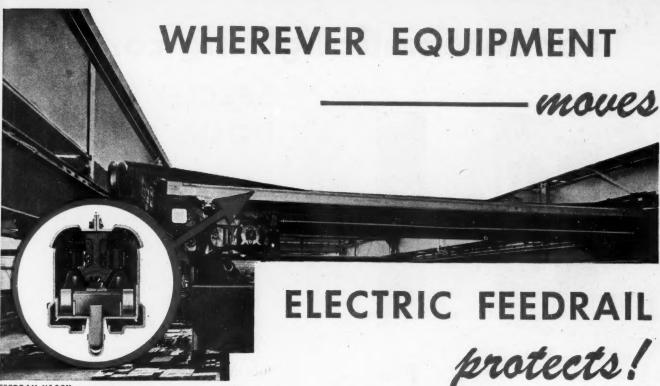
They Won the Spotlight

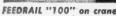
These new fluorescent fixtures for the home, by Virden of Cleveland, created a sensation at the New York Show. Their acceptance by Trade and the Public was instant.

Indisputable beauty through clever styling and utilization of the most modern in plastics is reinforced by lighting efficiency and ease of maintenance. And, needless to say, the traditional Virden skill in engineering details for mass production means realistic pricing.

Jobbers who sell Virden Lighting equipment will be glad to supply details.

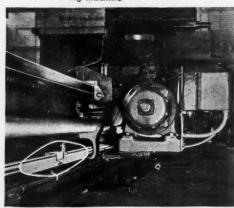








FEEDRAIL on cutting and moving cloth laying machine



FEEDRAIL on machine tool

Whenever you see exposed wires on a crane system, wires on the floor or awkward motions of portable tool operators — think of FEEDRAIL.

CRANES AND HOISTS

Electric Feedrail is an enclosed bus bar system having movable trolleys that make contact with the bus bars at all times. It is polarized, fused and grounded and each section carries the Underwriters' Label.

FEEDRAIL is protected against dust, mechanical injuries and mechanical shorts. It is furnished in assembled sections and curves. Also available for Slide Switches and transfers. Easy to install, inspect and service.

PORTABLE TOOLS

FEEDRAIL not only feeds but also supports all types of portable tools which may be readily disconnected by means of fused EVER-LOK connectors.

TEST RACKS

or any electrical equipment that has to be moved or rearranged to accommodate new production layouts is best served by FEEDRAIL.

ASK FOR FEEDRAIL CATALOGS GENERAL No. 15, NEEDLE TRADES No. 16, MACHINE TOOL No. 17

14



FEEDRAIL CORPORATION

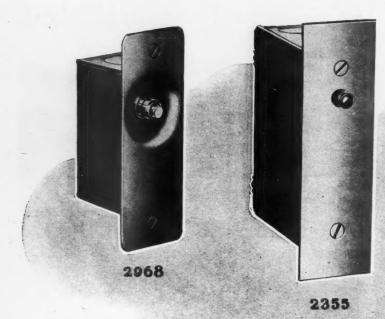
Subsidiary of Russell & Stoll Company

125 BARCLAY STREET

NEW YORK 7, N. Y.

For automatic lighting control

SPECIFY BRYANT DOOR SWITCHES





Avoid the lost time and annoyance of fumbling in dark rooms. Eliminate the possibility of leaving a forgotten light burning in a seldom-used vault or closet. Specify Bryant Door Switches for dependable and automatic control of lights in darkrooms, closets, vaults and storerooms. Positive and unfailing in operation, they may be installed in wood or metal door frames. Complete with box, adjustable plunger and striker plate, Bryant Door Switch No. 2355 is a "deluxe" device for 6 amp-125 volt, 3 amp-

250 volt service. It is supplied in either "on" or "off" position when the door is open.

A more compact device, Bryant Door Switch No. 2968 is furnished complete with all necessary parts ready for installation for 6 amp-125 volt, 3 amp-250 volt service. It is also supplied in either "on" or "off" position when the door is open.



Specify Bryant

Devices from

your Electrical

Wholesaler



This new especially formulated Irvington tubing, Fibron #5373, has all the advantages of conventional plastic tubings — plus the ability to remain flexible after varnishing and baking or extraordinary exposure to continuously high temperatures.

PARTIAL TEST DATA ON FIBRON #5373

Low Temperature Flexibility

I.V.I. Pinch Test40°C.

Bell Test30°C.

Heat Endurance (.166" ID tubing, .016" wall) (ASTM-D350-43T)

7 days @ 125°C. — Did not crack when bent 180° around ½" mandrel — Retains flexibility after being varnished and baked for 22 hours at 260°F. — No flow or drip during 8 hours at 300°F.

Fibron #5373 is produced in all standard colors and sizes—and can be supplied in heavy wall thicknesses—in 36" lengths, continuous coils, or cut pieces. For full particulars, and samples, write Dept. 96, Irvington Varnish and Insulator Co., Irvington 11, New Jersey.

IRVINGTON

VARNISH & INSULATOR CO. Irvington 11, New Jersey, U. S. A.

"Look to Irvington for Continued Leadership in Insulation"



INSTALL G-E FIBERDUCT RACEWAYS

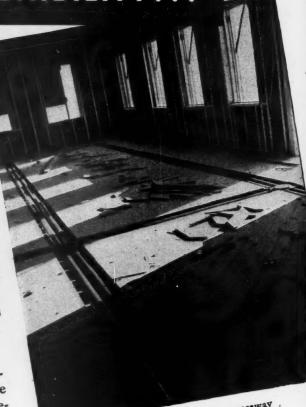
ELECTRICAL FLEXIBILITY.



This photograph shows factory-set Fiberduct outlets after the job is finished and the floor laid. Notice the electrical adequacy made available.

Your customers will be delighted with the electrical adequacy and flexibility you can provide them by installing G-E Fiberduct underfloor raceways. They are ideal for factories, airport adminisways. They are ideal for factories, airport administration buildings, banks, etc.—wherever there are

Electrical outlets can be preset in the duct at the factory or added later at any time. With G-E concrete or wood floors. Fiberduct, factory machines, office appliances, signal devices and telephones can be changed at will with assurance that power will be available for them in new locations. G-E Fiberduct is made of non-corrodible fiber and can be cut and installed easily.



Here a double-grid Fiberduct underfloor raceway. riere a double-grid riberduct underfloor raceway system will make high tension and telephone services readily available.

FOR FURTHER INFORMATION on G-E FOR FURTHER INFORMATION on G-E Fiberduct underfloor raceways or on G-E Q-Floor Wiring see the nearest G-E Merchan-dise Distributor or write to Section G-167-8, Appliance and Merchandise Dept., General Appliance Company, Bridgeport, Connecticut Electric Company,

INSTALL G-E Q-FLOOR WIRING with Robertson Q-Floors

G-E Q-Floor Wiring makes an entire Robertson cellular steel floor become part of the electrical system. Outlets can be installed anywhere every six inches.

GENERAL & ELECTRIC



Leader has always worked towards the finest in fluorescent lighting, excellent workmanship, careful design, accurate engineering . . . for New Horizons in fluorescent lighting.

In the latest Leader success, the New Horizon Series, you will find Leader quality throughout; plus new streamlining and simplicity made possible by Slimline Tubes.

The New Horizon Series are trim, compact, streamlined;

they lend themselves to modern trends of architecture and especially long in-line continuous run installations.

The New Horizon Series feature the new Slim-line F96T8 tubes and are manufactured for both Industrial and Commercial installations. There is a Leader Representative in your area with complete information on the New Horizon Series.

Distributed only through the better electrical wholesalers.

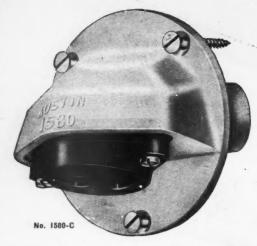
LEADER ELECTRIC MANUFACTURING CORP.

6127 NORTH BROADWAY . CHICAGO 40, ILLINOIS

WEST COAST FACTORY . 2040 LIVINGSTON STREET, OAKLAND 6, CALIF.

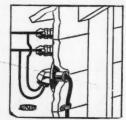
AUSTIN "Patented" FLANGED TYPE WEATHER-PROOF ENTRANCE CAP

UNITED STATES PATENT NO. 2.234.640

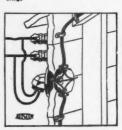




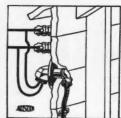
Austin No. 2004 Connected sortewed into hub rigidly and permanently holds non-metal-lie sheathed cable in the fit-



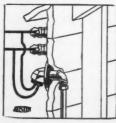
By screwing an Austin No. 7842 Chase Nipple into the hub non-metallic sheathed cable may run directly into the fitting



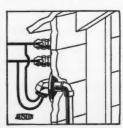
Can also be used with an outlet box by using Austin No. 7842 Chase Nipple which goes through bottom knockout and screws into hub.



Austin 9063-V Angle Box Connector screwed into the hub for armored cable or nonmetallic sheathed cable.



This wall conduit is easily connected to the hub by using No. 7671 EMT Angle Connector.



For $\frac{1}{2}$ Heavy Wall Rigid Conduit use Austin No. 450 $\frac{1}{2}$ Short Elbow.

BEHIND THIS FLANGE LIES ONE OF THE POPULAR "PATENTED" FEATURES OF THE ORIGINAL AUSTIN FLANGED TYPE WEATHER-PROOF ENTRANCE CAP

BEWARE OF IMITATIONS AND INFRINGEMENTS

The enthusiastic response that greeted the original Austin "patented" flanged type, weather-proof entrance cap has resulted in many imitations and infringements. Such an ovation establishes beyond doubt that this invention is a great contribution to the electrical industry.

Electrical contractors everywhere have approved it as a great accomplishment and one that had been too long neglected. Today, the original time-tested No. 1580-C Austin weather-proof flanged type entrance cap remains the best and most economical to install. It is fully protected by the United States patent No. 2,234,640, issued March 11, 1941, and license has been granted to a few manufacturers. All others are infringements.

To be sure—to be safe that you are getting the original—the best, look for the U. S. Patent No. 2,234,640 stamped on the fitting.

INSIST ON THIS "PATENTED" WEATHER-PROOF FEATURE

One of the important "patented" features of the Austin flanged type weather-proof entrance cap is the annular recess in the back of the flange or plate.

When the flange is secured in position, this recess, filled with weather-proof compound, makes a perfect moisture and air tight seal. The recess squeezes the compound around the hub and into the hole and protects the sealing material so that it cannot be tampered with or receive knocks which might injure the weather-proof joint.

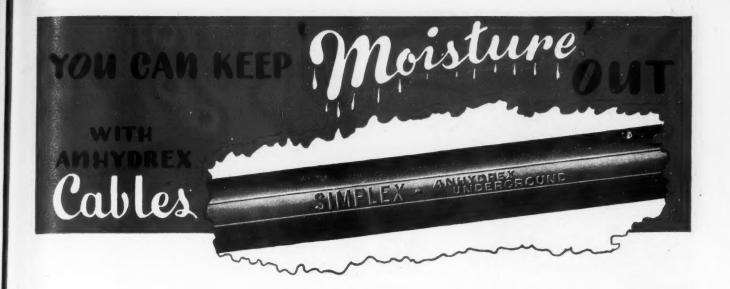
The cap is made of aluminum and cannot rust or deteriorate, eliminating unsightly rust streaks on the exterior of the building.

AUSTIN

PRODUCTS ARE SOLD EXCLUSIVELY THROUGH THE ELECTRICAL WHOLESALER

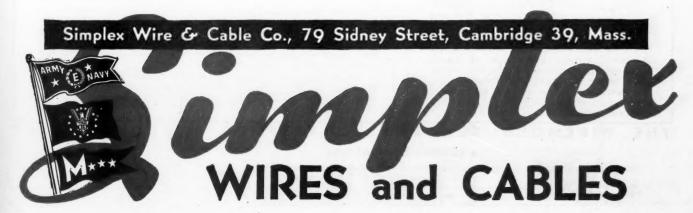
THE M. B. AUSTIN COMPANY

108-116 So. DESPLAINES ST. CHICAGO 6, ILL.

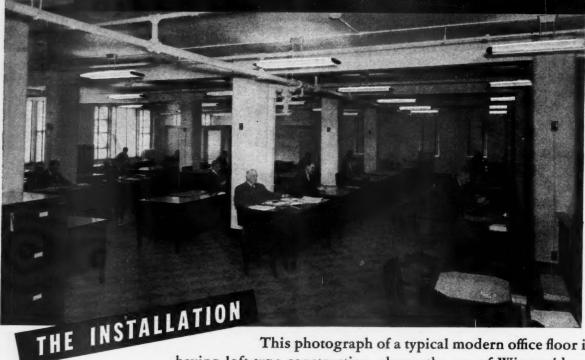


- Wet or dry, Simplex-ANHYDREX Underground cables operate efficiently.
- They need neither lead sheath or other metallic protection from moisture.
- They may be installed with or without ducts.
- They are not subject to electrolysis or corrosion.
- Millions of feet of ANHYDREX cables were made and installed before the war.
- Thanks to Simplex laboratories and engineers, Simplex-ANHYDREX cables insulated with specially treated and compounded Buna rubber have the same high resistance to water absorption as the prewar product.

Simplex-ANHYDREX Underground cables are the final answer under many conditions to a problem as old as the electrical industry.

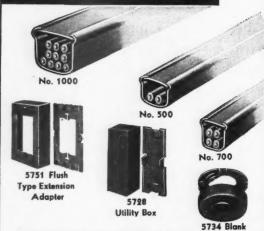


WIREMOLD FOR BETTER LIGHTING



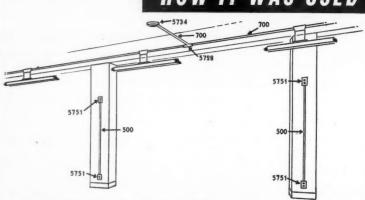
This photograph of a typical modern office floor in a building having loft type construction, shows the use of Wiremold to provide for proper location of modern fluorescent lighting units, and also on each column to connect with existing wiring to provide outlets for fans and office machines.

WHAT WAS USED



With easily installed Wiremold Raceways and a minimum number of well designed Wiremold fittings, every type of installation may be completed all the way "from panel boxes to outlets". Wiremold is unobtrusive, strong, safe and permanent. Later changes or additions are quickly and easily made.

HOW IT WAS USED



In this case Wiremold No. 500 and No. 700 Raceways and fittings were used throughout. Where additional capacities are required, No. 1000 and larger Raceways may be used interconnecting one with another to provide a complete wiring system. Many office wiring layouts will also use No. 1500 or No. 2600 "Pancake" Wiremold Overfloor Systems for telephone connections to desks and Plugmold plug-in-anywhere Systems to provide convenience outlets for lamps, appliances or machines.

Write for Engineering Data Sheets and other literature showing how and where Wiremold can help you complete your postwar wiring modernization program faster, more effectively and often at lower cost.

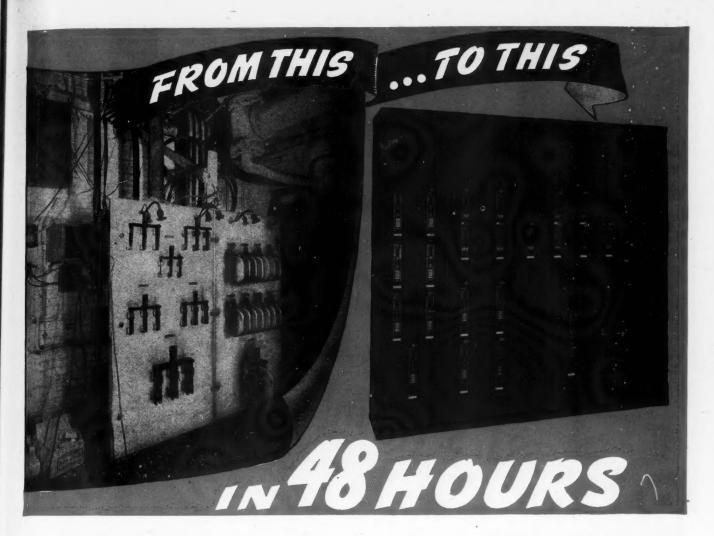
THE WIREMOLD COMPANY ... HARTFORD 10, CONNECTICUT



ELECTRICAL CONTRACTORS

Business publications like these, with aggregate circulation of over 240,000 monthly among your prospects and customers, carry Wiremold advertising messages designed to HELP YOU BUILD BUSINESS. Tie in with this aggressive promotion program.





INSTALLING a new switchboard doesn't have to be a big job. The Shaw Electric Company of Newark just recently made this interesting installation.

In addition to the old live face distribution switchboard there were four large cabinets housing the service equipment. Though this change-over was made while the building was closed, it is frequently possible to install a section at a time with only slight interruption of service.

Interesting, too, are the individual (A) SHUTLBRAK switches embodying an entirely new switching principle, that of rolling contacts with a faster-than-the-eye

shuttle motion within a completely insulated, damp proof chamber. Quality of performance and ease of operation actually improve year after year as the heavily silvered copper rollers move into position under line pressure contacts.

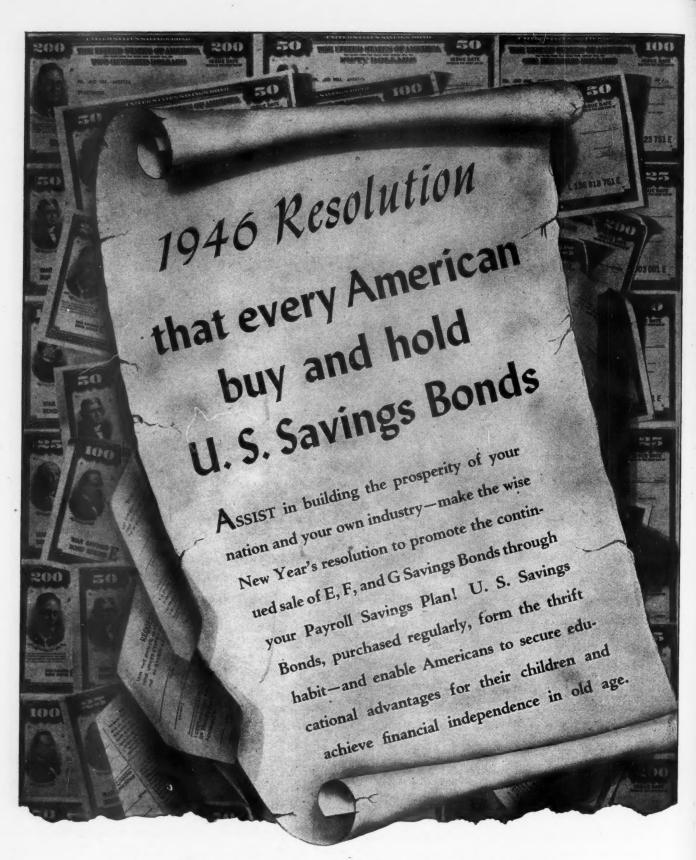
Frank Adam SHUTLBRAK switch-boards have a full range of capacities from 30 to 1200 amperes, 250 volts AC or DC and 575 volts AC in 2, 3 and 4 poles. Write for the name of our nearest representative. He will be glad to answer your questions without any obligation.

Frank Adam Electric Co., Box 357, St. Louis, Mo.





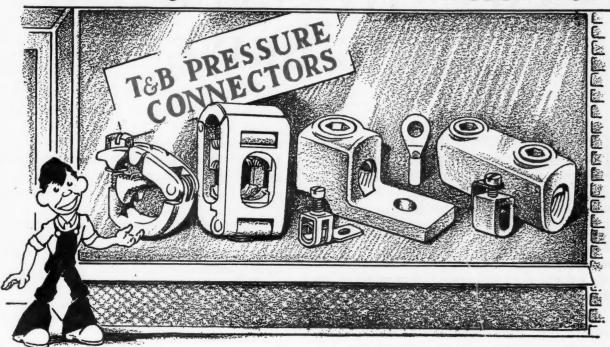
Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT



The Treasury Department acknowledges with appreciation the publication of this message by

ELECTRICAL CONTRACTING

Your T&B Electrical Wholesaler



READY AND WAITING FOR YOU

For your construction, reconversion and production wiring, T&B Pressure Connectors are ready and waiting to do a job for you. They are made to handle all types and sizes of wires and cables from #22 up to 1,000,000 CM. Being designed and engineered by pioneer manufacturers of quality electrical products, you know what to expect:

Approvals by Underwriters Laboratories
Ease of installation. Safety
Uniformity of results
Perfect electrical and mechanical connections
Resistance to vibration and corrosion
Preference over solder by operatives
Economy of material

And you know where to get them right now: From the stock of our sole Distributors—your local or nearby T&B Electrical Wholesalers.

FOR NEWCOMERS

For the benefit of newcomers in your organization, we will be glad to send free samples of T&B Lock-Tite* Connectors and Sta-Kon* Terminals,** with technical and installation facts. This material will bring them up to date on these two famous T&B Lines. Kindly use company stationery and address our head office.

*Trademark Reg. U.S. Pat. Off. **Patented



THE THOMAS & BETTS CO.

manufacturers of electrical fittings since 1898

ELIZABETH.1. NEW JERSEY In Canada: Thomas & Betts Ltd. Montreal



INCENTIVES FURNISH THE DRIVE

THE COMING YEAR, 1946, and the years to follow can bring unprecedented prosperity to the people of the United States if the incentives to secure it are provided.

We have the advantage of starting with an economy which has demonstrated a capacity for expansion unequalled in any other country in the world. Our economy has demonstrated, also, one grave weakness—a recurring interruption of the upward trend of production and living standards by wasteful and paralyzing periods of recession. Recovery from each depression always has carried us to new heights of economic welfare, but the toll of the years of blight has been harmful to everyone.

The job ahead of us is a dual one. We must maintain the vitality of an economy which, over the years, has yielded an enormous increase in the American standard of living, and we also must improve its stability.

The Dynamics of American Production

In the last prewar year, 1940, the population of the United States was 3½ times as large as it was in 1870. But the national production, measured in dollars of constant purchasing power, was 10 times as large at the end of the period, and industrial output had increased 20-fold.

In the meantime, the average number of hours of factory workers had been reduced from about 63 per week in 1870 to less than 40 in 1940, while average hourly earnings had more than trebled in dollars of constant purchasing power. Thus "real" weekly or annual wages in manufacturing had doubled over the 70-year period, even though the work-week was cut by 35 per cent. This was made possible chiefly by a tremendous increase in the quantity and quality of the mechanical facilities which were provided in American manufacturing industry. Manufacturing capital investment per worker was multiplied by 6 times over the period in question. But the

return per dollar invested, while it has fluctuated widely between good years and bad, showed no general upward trend over that portion of the period for which measurement is practicable.

Incentives in American Manufacturing

There has been, historically, a remarkably consistent pattern in the division of the realized income from the expanding manufacturing output of America. Reliable statistics are not available for as far back as 1870, but from 1899 through 1939 the average share of wages and salaries has been 82½ per cent against 17½ per cent as the share to investors (including dividends, interest, rents, royalties, and non-corporate profits). There have been, from year to year, relatively minor divergences from this pattern of distribution, but there is no discernible trend during the period away from the averages cited.

It is suggested that the persistence of the average 17½ per cent share of realized income from manufacturing that was maintained for the 40 years preceding World War II may represent the proportion that is needed to produce the dividends, interest, rents, royalties, and non-corporate return that will provide for the continuing investment upon which an expanding productivity such as we have had in the past depends. At any rate, it would seem reckless to depart too radically from such an established pattern at a time when unprecedentedly large private capital investment is counted on to make up for the drastic curtailment of such investment during the war years, and to carry us to the new high levels of civilian production set as our postwar goals.

The Distribution of Manufacturing Income in War

At the beginning of the war, the Government adopted controls and a tax program designed to prevent wartime activity from resulting in unduly swollen private returns. Due primarily to huge volumes, the profits before taxes of manufacturing industry were very high, but throughout the war its profits after taxes averaged returns no larger than they had been in good prewar years. Relative to volume, they were considerably lower than in prosperous years in the past. Again, there can be no complaint at results that generally were in accord with a national wartime policy.

But it is fair to note that the wages of manufacturing labor were allowed to increase substantially during the war. Between January 1, 1941 and April, 1945, average weekly earnings per worker increased by 77 per cent. This was, in considerable part, a result of increased working hours and a shift from low- to high-paid industries, but straight-time hourly earnings on the same jobs increased about 40 per cent against a cost-of-living rise of about 30 per cent.

The net result was to alter drastically the 40-year relationship of the $17\frac{1}{2}$ - $82\frac{1}{2}$ per cent division of Realized Income from Manufacturing. The share of wages and salaries increased to over 90 per cent, and the investment share shrunk to less than 10 per cent.

Its Postwar Distribution

This wartime shift in the proportion of distributive shares has an important bearing upon current wage controveries. With union demands for wage increases ranging up to 30 per cent, and the economists of the Office of War Mobilization and Reconversion asserting that an average increase of 24 per cent is feasible without raising prices, it is pertinent to inquire how such increases would affect the prewar ratios that governed realized income distribution in manufacturing.

Forecasting is always hazardous, but if we assume (1) that in 1946 we shall reach the \$160 billion level of national output which the Government proponents of general wage increases expect, and (2) that there will be little increase in productivity because of the continuing process of reconversion, and (3) that the Government will succeed in carrying its announced purpose

to maintain present price ceilings, it appears that a 24 per cent general wage increase would reduce the share going to capital from 17½ per cent to 11 per cent even allowing for its increased return resulting from the repeal of the excess profits tax. The prewar ratios would be about maintained if wages remained at present levels.

Conclusion

Since the maintenance of these prewar ratios was accompanied by an unparalleled rise in the "real wage" of American workers, there is a powerful prima facie case for not tinkering with them. It should be noted, however, that some economists think that the size of the investment share of manufacturing income tends to provide more capital than can be absorbed by a mature economy, and thus contributes to those breaks in the expansion of the economy which, as stated at the outset, have been its principal blight.

Regardless of what may ultimately prove to be the validity of this view, no one can responsibly contend that at this early but crucial stage in the reconversion process is the time to test it. Now, no one knows whether, or what dimension of, additional wage increases can be supported without forcing up prices or reducing profits to a point that will discourage vitally needed private capital investment.

We want high and increasing wages in American manufacturing. We need them to provide an active incentive to workers to support expanding productivity, as well as to continue the trend of rising living standards in America. Equally, we need a continuing profit incentive of sufficient attractiveness to call forth the new investment upon which expanding productivity depends.

We can never attain our dual objective if we push one of these aims so far and so fast that it defeats the other.

Mus H. W. haw. N.

President, McGraw-Hill Publishing Co., Inc.

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JANUARY at a Glance

At this time of year it is customary to project our thoughts and plans for the year, to add up what has gone before and what is likely to happen in the months to come. The year 1946 looks good. In fact, it is difficult to see how anything but a major economic disaster can prevent it from being one of the greatest years in the electrical business. The dangers are not that there will be insufficient business, but that under the pressure of so much activity we shall miss out on some important opportunities for sound development of the industry. You will find "Looking at '46" a quick round-up of what appears to be immediately ahead.

*

What reconversion means in electrical work is clearly illustrated in Gus Eckel's article about an automobile plant reconversion job in Flint, Michigan. The work of clearing out war production lines and setting up for the manufacture of automobiles involves extensive changes in wiring, much new equipment, temporary lines and salvage operations. You will find the story, "Automotive Plant Reconversion" on page 50.

4

Overhead costs are a subject of prime interest to contractors everywhere. Wartime salaries and increased fixed costs, distribution problems and buying practices, and many other changes have affected the conventional overhead picture. The Chicago Electrical Estimators Association and the Chicago Electrical Contractors Association have assembled figures in a study made under the direction of Chairman A. C. McWilliams of the Committee on Analysis of Operating Costs and developed some data that will be of wide interest to contractors everywhere. This article, "Analyzing Overhead" on page 61, is by way of a preliminary report on the work to date. A more complete and detailed article is already in preparation by Ray Ashley and will be announced in an early issue.

Farm electrification, which has consisted primarily of bringing the comforts and conveniences of electric service to the farm home and out-buildings, is due for great expansion once the farmer learns how he can make electrification pay in the work of the farm. W. D. Hemker, Westinghouse Electric Corporation, has given us in his article, "Farm Electrification Pays", on page 68, a round-up and detailed study of farm electrification doing a production job at a profit for the farmer. Here is important sales ammunition for everyone concerned with the enormously important rural electrification market.

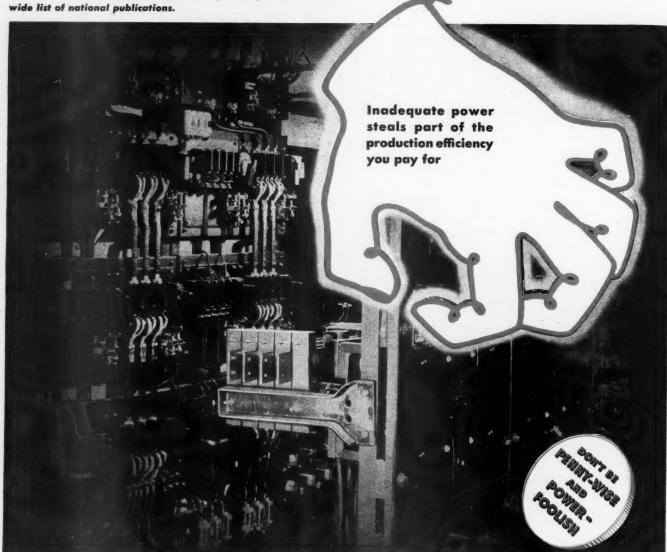
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Arc welding has become a very common device in manufacturing and assembling. It is the only widely practiced industrial occupation in which the operator handles a live electrical circuit all day. It is naturally surrounded with some hazards and dangers, many of which can be eliminated by careful planning and operation. In "Safety Factors in Arc Welding", R. F. Wyer of the General Electric Company, reviews some of the hazards of welding and preventive measures that can be taken.

*

Silicone varnish is a new product finding wide acceptance in the repair of electrical equipment. It is capable of withstanding considerably higher temperatures than conventional organic materials and consequently has been found valuable for the repair of apparatus which must be able to withstand unusual heat or moisture conditions. It requires a different baking cycle than organic varnishes. In the article, "Bake Ovens for Silicone Varnishes", P. A. Meyer, Chief Engineer of Young Brothers Company, discusses the baking cycle and the proper oven construction necessary for effective utilization of the new varnishes.

Because of the basic importance of adequate wiring to the entire electrical industry. Anaconda is presenting messages like this in a wide list of national publications.



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ANACONDA WIRE & CABLE COMPANY

MOST FOR THE MONEY

This business of carving out a brave new world is mighty slow. Peace, unlike war, offers no obvious, simple objectives for everyone. It demands a lot more foresight. It requires a lot more individual thinking.

One keen minded contractor has proposed a peacetime objective for the electrical construction industry that I want to go along with. First because it's realistic, second because it's farsighted and last because it's plain good common sense. Here it is—"Let us strive to give the maximum value for the minimum price consistent with sound business practice."

One thing about a good rugged objective is its quality of directing decisions and resolving problems. Let's put this slogan to the test. Let's see whether it can give us the direction and certainty that is so conspicuously absent today.

Take lighting, for instance. Here are several choices, all immediately profitable. (1) Give the customer what he asks for, never mind the engineering. (2) Let him buy his fixtures anywhere, take the hanging with a good thick margin. (3) Get a cheap line, undersell the competition, save him money. (4) Give him well planned lighting, at a fair price.

We don't have to get beyond "maximum value" to find perfectly clear direction from our objective. Anything less than well planned lighting cannot be maximum value. Anything more than a fair price cannot be a "minimum price consistent with sound business." If we accept the objective the way is clear. There is no choice. There is no problem to solve.

Or take the question of whether or not to use modern job management methods and efficient tools. Should we bother when competition is easy and we can get the price anyway, or should we use every device and method to hold unit costs down? Our objective again gives us no choice but to go out and use the most efficient management and equipment we know.

And here's a tougher question and an exceedingly common one. Shall we strip our organization to the bare essentials of bidding and bookkeeping or shall we build up our facilities for sales, job management and engineering? Our "maximum value" objective answers that one easily. For how, in an expanding, growing industry constantly reaching new horizons, can we give maximum value without the essential machinery of strong sales policy, progressive management and sound engineering?

Industry, labor, government—and just plain folks—all need some pretty clear cut objectives in these critical months ahead. With the opportunities in the way of electrical construction there are going to be many confusing paths to choose between. We need objectives that will give us the fullest possible development of the market potentials. And one of them ought to be "maximum value at minimum price."

Wm. J. Stuart

Electrical Contracting

JANUARY, 1946



LOOKING at '46

By W. T. Stuart

A forecast of the markets, the opportunities and the problems for electrical construction and maintenance in the months ahead.

VERY year at this time we gather together reports from various sources, notes from interviews with industry leaders, plus significant data from research, and add them up for the guidance and direction they might give us for the year ahead. In this first year of peace many of the trends and potentials that we could only guess at before are becoming clear and sharp. Barring economic chaos, runaway inflation, a stalemate in labor-management negotiation or other possible but improbable disasters, we are facing markets just about as big as we have the boldness and foresight to make them. We are facing opportunities that demand our best imagination and ability. Though we have some problems too that have got to be solved, altogether the prospects are bright.

New Construction

Predicted new construction volume for 1946 is about \$6.5 billions with a five year increase to a level of \$15.5 billion. The 1946 figure, however, is based on a more rapid recovery of the building industry than is so far apparent. Electrical work, associated with new construction, should approach \$500 millions if the predicted construction level can be achieved.

Several factors in new construction, however, make forecast estimates on electrical work subject to wide error. All trends point to new high levels in the percentage of the building dollar which is earmarked for electrical work. Aggressive market development can

bring about independent use of electrical devices which require wiring and skilled installation; ranges, water heaters, bathroom heaters, for example, and such wiring and installation work is a substantial addition that can easily push electrical work to new levels. Lighting, discussed in greater detail under its own category in this article, shows definite evidence of reaching market levels so much greater than ever before that the relationship has to be expressed in multiples rather than as a percentage.

Thus a single new device widely accepted or even a moderate step forward in public demand for modern lighting can make the most optimistic forecast fall far short of the true potential.

New industrial construction will continue to be a major market in 1946, with new commercial work gaining rapidly. The backlog of institutional buildings, with the exception of hospitals, will probably not become a large factor until late in the year.

Modernization

Repair, rehabilitation and modernization are taking a major part of the present resources of materials and manpower. Estimates place this market for electrical work in the first six months of 1946 at from one quarter to one half the total business potential. If new construction lags appreciably in the first two months, the fraction may be even larger.

Obsolescence, overburdened apparatus, inadequate wiring systems, lack of maintenance and ordinary wear and tear have taken a toll during the past five years far beyond the replacement and repair facilities which have been available. The dollar volume, therefore, of remodeling, repair, relighting and other electrical work not directly related to new construction activity may approach 250 millions for the year.

Rural Electrification

There are still more than 5 million rural homes without electric service. About 600,000 are so remote that they are unlikely to have central station power. The remainder are a tremendously important market for wiring and electrical equipment. Line building is under way but seriously impeded by shortage of poles an dskilled manpower. However, rural wiring can be tagged as a major market for 1946. At a conservative estimate of \$125 per job, the electrical work exclusive of line construction is a market potential of over half a billion dollars.

Most farmers, however, are using electric service primarily for lighting and household appliances. The application of electric light and power to farming operations is only beginning. Even an elementary application of power equipment can radically increase the farm market potential for wiring and electrical equipment to levels far beyond current experience. Further, any important development in utilization on the farm will open up opportunities for wiring sales on farms already wired. Much of the earlier rural work was done at minimum code standards to hold costs down, with

no provision for farm machinery. These jobs are already inadequate. Another important factor in the rural market is that farmers are no longer a depressed economic group. They can and will buy quality and convenience.

Residential

Administration efforts to channel 50 percent of available building materials into low cost homes is evidence of the urgency of the home building job. Whether the plan can be administered is subject to some doubt, but in any case 1946 will see one of the biggest home building booms of all time. And house wiring, a comparatively minor market through the war years, is due for tremendous expansion. Even if the million home goal is not reached this year, and it is not likely that it will be, the wiring job will be one of the biggest ever tackled by the industry.

Some predictions place wiring and fixtures at an average of about \$400 per home reflecting higher standards of adequacy and more built-in lighting. With "adequate wiring" promotion creating pressure from the public on builders even the low cost projects show trends toward more wiring and more electrical facilities. The revised Handbook of Wiring Design, timed for next month or very soon thereafter will also influence builders and architects toward better wiring systems.

Lighting

One of the greatest opportunities the electrical industry has ever faced is the 1946 lighting market. And in the forefront of the sales job the electrical contractor has a critical responsibility to make the most of it. A few recent lighting jobs are pioneering new areas of illumination that can radically change our way of life. The trends show a marked emphasis on functional lighting planned for high intensities, low brightness and new standards of quality all geared to a specific lighting result. Modern engineering practice no longer stops at luminaire and lamp design, but is carried all the way through to the final installation and even into mainte-

Estimates of the potential lighting market are particularly difficult to make because of the very rapid progress already under way. Comparison percentage-wise with previous years become meaningless since the apparent market ahead must be considered in terms of multiples of any previous ex-

perience. Individual lighting jobs are running from two to ten times the value that would have been considered for an up-to-date job only ten years ago. And modern lighting is carrying with it comparable increases in wiring.

Whether this development will be carried to its full potential or allowed to fizzle along the way belongs in the category of compelling problems before the industry today. And this problem is focused squarely on the men who must lay out and install lighting systems. Industry leaders are practically unanimous in declaring that only reluctance on the part of the industry itself can impede the development since no serious resistance levels of public acceptance for modern lighting are in sight.

Maintenance

Improved supply of new motors, apparatus and wiring materials is relieving some of the patchwork maintenance problems of the war years.

Reconversion to civilian production and the need for holding down costs is bringing renewed emphasis on methodical preventive maintenance, scheduled replacements and routine check-ups to stop trouble before it happens.

With more opportunity for product selection electrical maintenance chiefs are examining apparatus and equipment with a critical eye for features that contribute to easy maintenance.

Scheduled lamp replacement and lighting system maintenance methods developed for industrial plants is now being made available to commercial buildings through lighting maintenance contracts by some electrical contractors. Manpower shortage is still limiting the work but such contracts will probably be in wide use before the end of the year. With the importance of good lighting more clearly recognized by the public and the increasing complexity of modern fluorescent lighting systems, the maintenance contract is a natural and needed development that will bring in a substantial volume of business.

A review of markets ahead would be incomplete without a quick look at some of the industry conditions from which it will be approached.

Code Revision

Last October the Electrical Committee of the National Fire Protection Association met to revise the 1940 Code. The new 1946 revision will be issued late this year. It will contain several new articles pertaining to apparatus which has come into wide use since the last revision.

The new code includes for the first time an article covering electric welders. Fluorescent lighting, new at the time of the last code, is covered in a new article on fixtures. Rules for "cold cathode" systems are also included.

A new article on machine tool wiring contains rules originally included in an interim amendment. Infra-red heating installations are also covered by rules developed out of wartime experience.

Rules pertaining to remote control, low energy power and signal circuits which appear in the '46 revision for the first time reflect the great increase in the use and importance of control circuits coming out of industrial practice in the past few years.

Revisions generally, though great in number and intricate in detail, are moderate and pretty much geared to the essentials needed to bring the code up to date.

Labor

The labor front in electrical construction, unlike most industry today, is both stable and peaceful. The long history of cooperation between labor and management in this field is unlikely to be marred by any foreseeable major controversy ahead.

Critical shortage of skilled mechanics in industrial areas still prevails with little hope for early relief. Returning service men and release of electricians from the ship programs are filling some of the gaps but too slowly to take up the increased volume of work.

Despite active committee work by NECA and IBEW with strong support from government, apprentice programs are getting under way too slowly to compensate for even the normal depletion of the ranks by retirement and death. Leaders in labor and management both are deeply concerned. Lack of skilled men may require filling the ranks with men of uncertain training, weakening the bargaining power of the unions. Management sees the declining ranks of highly skilled men as threatening their ability to install and maintain apparatus of growing complexity. This year will see a concerted drive by joint committees to attract able young men to electrical work through apprenticeship.

Bidding

Generally, bona fide bids in competition are up about 30 percent over pre-

war levels. The prices reflect higher material cost, higher labor unit costs and difficulties in material procurement. While material prices have not risen very rapidly, it is often necessary to substitute other than specified brands or quality, usually at a higher price level and sometimes in small lots from several suppliers, in order to expedite the work. Labor rate increases are not considered as significant as the general decline in man-hour productivity. This is due to the dilution of skill evident in the present tight labor areas, postwar let-down and the general pattern of indecision, unrest and irresponsibility which has followed the compelling urgency of war work.

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Reports of very high bids, completely out of line with prewar prices, are pretty much discounted by the initiated as "courtesy" bids, a nominal high bid not intended to get the job, but to keep the firm's name on the list of active bidders. In normal times the practice is unimportant. However, there have been some recent instances where none but "courtesy" bids were received, resulting in unjustified charges of gouging and collusion.

Many firms are refusing to bid lump sum prices due to the uncertainty of future material prices and labor policy. They are accepting only T and M or cost-plus contracts. There is a good deal of interest in T and M with an upset limit. They feel that the high bids they would have to make to cover future uncertainties and risks would tend to discourage owners from going ahead with wiring plans. Contract arrangements in which owners share the risks of the transition period will permit the contractors to develop the necessary cost experience and reduce the risk contingencies to a point where stable and accurate lump sum estimates can be made again.

Problems Ahead

Since the beginning of the reconversion period, *Electrical Contracting* has conducted a research project to find out what electrical men consider the important problems ahead. By a sampling method we selected a crosssection of the industry and asked them to voice their opinions frankly.

In spite of the relative tranquility of the immediate labor situation, labor relations ranks first among industry problems in our returns. But the problems cited are not all "wages and hours." They range from the general, "better cooperation between labor and management," to the more specific, "skilled men who can maintain the new electronic apparatus in industry." Some see the labor problem as primarily economic. As one contractor says, thoughtfully, "I am less concerned with specific rates, hours and working conditions than with the effects of increased costs on our business. We can get business today, easily, on our own terms. But are we, as an industry, pricing ourselves out of the mass market?"

Many were concerned about labor skills and training. "Better education of mechanics on code requirements," one prominent electrical inspector claims, "is a number one problem." "Give veterans a chance for retraining and refreshing in their old jobs. Some have been away a long time," says another. "Greater labor efficiency and training of the workers is what creates jobs" is the theme of several comments. In general the returns placed much more emphasis on greater productivity and skill from labor than wage levels. "Quality of workmen has gone to a record low,"-"the shortage of qualified and experienced workman"-"a fair deal from labor in production" are typical of these opinions.

Replacement of war emergency wiring and bringing existing wiring systems up to modern standards of safety and adequacy ranks high among immediate problems ahead according to a great many of the research returns. "The industry must find a way to sell rewiring." "We must replace worn out and obsolete wiring and equipment with modern and efficient systems."—"A program should be started to bring all wiring up to standard and then keep it that way by reinspection every few years." These and similar comments show the trend of thinking on the problem.

"We must educate the public to the value of adequate and safe wiring installation and providing for increased postwar use of electrical equipment," says a prominent midwest contractor, in concert with many others who see market development as the greatest problem ahead, particularly in adequate wiring. "A better grade of material for farm wiring and active promotion of rural electrification to boost food production with less farm labor" voices a problem that stands high in the thinking of electrical men in the rural areas. And a demand for progress in materials and methods is evident in such comment as -"Let's get away from our prewar products and ideas and take advantage of the new materials and methods learned in war production."

Business stability problems show a

high rank among the contractors. To the question of our most important problem ahead one answers, bluntly, "Chiselers!"—another wants a code of ethics in competitive bidding, others suggest licensing and the elimination of unqualified firms from electrical work. Others seek "better cooperation between the wholesaler and contractor, elimination of retail sales at wholesale prices of wiring materials and fluorescent fixtures"-"electrical materials requiring skilled installation should be restricted to electrical supply houses." These and similar comments typify the growing concern over distribution policies where contractors find themselves in direct price competition with their own sources of supply and where retail outlets sell at prices approximating contractor cost.

Reemployment of war veterans is also rated as an urgent problem, reflecting the short labor supply.

Some problems which do not appear frequently in the study come from men whose thinking has proved pretty solid on industry matters. Two of them particularly, deserve a voice here. One seeks improved fair trade practices to stabilize business relationships, planning to provide full time employment and a concerted effort to improve the technical and management facilities of electrical contractors. Another sees sales promotion methods and public relations as subjects of vital importance.

Conclusion

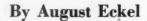
There is every indication that 1946 will see the beginning of a building boom probably unparalleled in history. Trends are toward more functional construction with the electrical facilities rising to first rank importance. There will be consequently a larger share of the building dollar going electrical.

New electrical developments are requiring more wiring, more installation work and more skilled maintenance. Aconsiderably greater responsibility for electrical developments rests upon those responsible for selection, application and installation of electrical wiring and apparatus.

Prospects for 1946 in electrical construction and maintenance are the brightest in many years. There is, consequently, real danger that needed market development work with the future of the industry in view will be slighted. How ably and aggressively electrical construction men attack the opportunities of 1946 will set the pace for the entire electrical industry for many years ahead.

Reconversion of Flint's General Motors plants to peacetime production involved extensive remodeling of the electrical systems.

Automotive PLANT RECOM



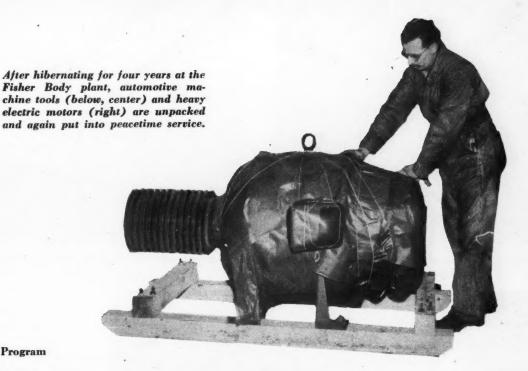
To the layman, peacetime reconversion implied a simple shift from the production of war materiel to the assembly of the cars, washers, ranges, appliances and hundreds of other commodities he has long wanted. To the industrialists and their engineers, it represented one of the toughest jobs they have encountered—even larger in scope than conversion to war work some four years ago. In the automotive industry it was more than a simple substitution

of automobile assembly lines for the tank production lines of 1941–1945. It meant a virtual reshuffling of many department and building operations; development of plans incorporating necessary expansion of facilities; and a general rehabilitation of usable equipment. The electrical system—the life-line of both war and peace production—had to be thoroughly revamped to meet future demands and conform to pre-war standards of efficiency and safety.

Typical of the electrical reconversion problems in automotive plants operating in pre-war buildings were those encountered at two Flint, Michigan, plants—where an estimated investment of approximately three million dollars is being devoted exclusively to light and power wiring and electrical equipment for production purposes. These two plants are the Buick Motor Division and Fisher Body Division of the General Motors Corporation.

Where tank destroyers were assembled at Buick during the war (photo above), new postwar cars (below) now come off the assembly line. Electrical system was completely revamped.





A Seven-Point Program

At the Buick Motor Division, a sevenpoint electrical reconversion and expansion program covered the following categories:

1. New Buildings—Wiring and distribution equipment for power and lighting in new building construction. This covers about one-third of all the electrical work planned.

2. Reconversion of Old Buildings—Tearing out of electrical systems used in war production; revamping and installing distribution systems required for automobile production (installation of bus duct and conduit to replace wartime open wiring distribution). About 35 percent of the total existing electrical system is being revamped. More automatic production techniques are being planned.

3. New Equipment — Transformers, large circuit breakers, and other heavy service and main distribution equipment.

4. Reconnecting Machines—Shifting and connection of production machines and reconnection of units stored during the war.

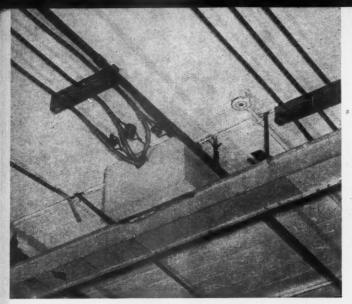
5. Temporary Pilot Lines—Installation of electrical service to a relatively few units on each production line to facilitate manufacture of enough parts to get car production rolling.

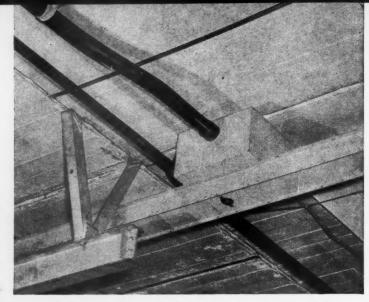
 Salvage of Electrical Equipment— All electrical equipment that was shifted was tested and reconditioned before reinstallation. Many of the stored ma-

Automobile bodies again roll through the electric spot-weld "jungles" at the Fisher Body plant.

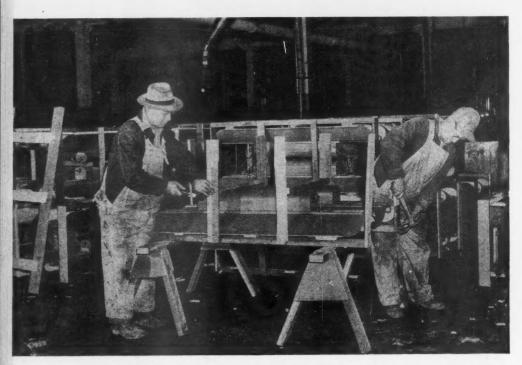


Electrical Contracting, January 1946





Wartime open-wiring bus duct feeders (left) are all being replaced with conventional conduit installations (right).



RF lighting units from a dismantled building are crated for safe storage while new structure is built. Units will be re-installed.

This wartime machine shop at the Fisher Body plant is now a material storage area. Note all the electrical work that had to be dismantled and replaced with a conventional storage lighting system.



chines were without electrical controls (these were used on war production machines to get started in a hurry). Other starters and motors had to be reconditioned after finishing their wartime grind.

7. Miscellaneous Systems — Signal systems and other miscellaneous devices.

High Voltage Distribution

Buick's reconversion plans included expansion of production facilities through the addition of 1,325,000 sq. ft. of manufacturing area. This was accomplished by replacing old one-story buildings by modern three-story units and enclosing open courts between existing buildings. Electrically, this means an estimated peacetime peak demand of 50,000 kva.-25 percent more than the wartime peak. Wartime experience with the difficult control of large substation interrupting capacities at peak demands dictated decentralization of 4800-volt primary distribution substations at power centers. Including service to the new buildings, this involved the installation of eight new substations and the scaling down of existing ones to smaller capacities. Metal-clad switchgear is being installed throughout the plant and, due to recent advances in design, air circuit breakers are replacing all 4800-volt oil breakers.

Continuity of service is assured through an open-loop bus tie which interconnects the secondary sides of the distribution substations. Bus duct distribution is used extensively. Three buildings are completely changed over to this system, which replaces much of the undesirable wartime open wiring.

What was once a wartime storage area is now a new "cut and sew" section of Fisher's auto body upholstery department. New flexible power distribution and high intensity lighting were installed.

Rearrangement of lighting branch circuits and intermediate distribution comprised a significant part of the electrical rehabilitation. Distribution is now effected through individual 440/110-volt transformers located at the center of the lighting loads. Intensities were boosted from the prewar 10-15 footcandles to a general minimum maintained level of 35 footcandles. Fixtures are predominantly the industrial RLM fluorescent unit with steel reflectors and two 100-watt lamps. Choice of this unit was influenced by the fact that, compared to the 4-lamp, 40-watt fixture, fewer of these units are necessary to secure the same intensity, and maintenance cost is reduced considerably. All fixtures are mounted to trolley duct supported by angle iron (instead of conventional messenger cable). This angle iron network-used before in Buick plants-was designed as an integral part of the building steel in the new structures.

War-time Substitutes Replaced

Approximately 65 percent of the highcycle tools were stored during the war. In many of the buildings the 180-cycle distribution system was torn out for war production and had to be re-installed.

Controls for machine tools are now back to rigid company specifications. During the war—due to shortages—almost anything was accepted and used. Consequently, quite a substantial part of the controls were replaced.

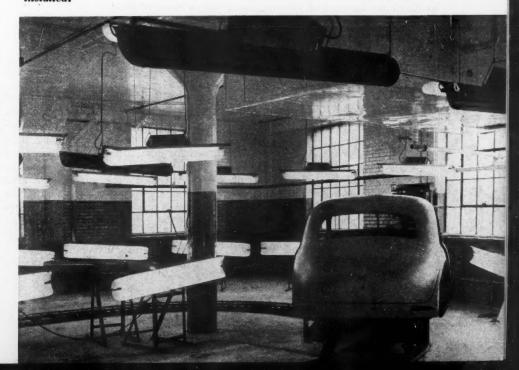
Unit cost estimates for electrical reconversion (excluding equipment) at Buick ran approximately 75 cents per sq. ft. for the new buildings and about 25 cents per sq. ft. in existing structures.

Handling Buick's electrical reconversion, under company engineering staff supervision, are three electrical contractors: Harlan Electric Co., Detroit; LeMire Electrical Construction Company and United Electric Company of Flint. In addition to the heavier items of electrical equipment, upwards of 2,000 ft. of enclosed feeder bus duct; 12,000 ft. of plug-in type distribution bus duct; and 100,000 ft. of trolley duct

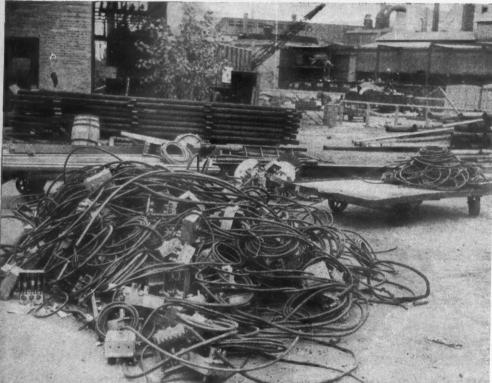




Plant areas such as this (above) used for tank sparc parts storage during the war at Fisher now house body production lines like the paint spray and polish department (below) where new power and lighting systems had to be installed.







Salvaged plug-in bus duct cable drops await removal to maintenance department at Buick for testing and reconditioning before re-installation.

for lighting are being installed in the various plant buildings.

Fisher Body Reconverts

At the opposite end of town, the Fisher Body Division of General Motors Corp., devoted its 4½ million sq. ft. of floor space entirely to war production of tanks and other items. With V-J Day came the tremendous task of reestablishing the plant on a civilian production footing. Although automobile bodies are already rolling off the lines, complete reconversion to normal peace-

time capacity is not expected until early in 1946.

Unlike Buick, this organization had no new building construction to face. It was primarily a problem of reshuffling departments and reequipping plant areas for normal mass production techniques. Typical examples of what the work involved: one main floor area that was a heavy machine shop during the war is now a storage area for materials. This shift necessitated removal of all machine tools, power distribution and high intensity RF lighting and reinstallation of the normal incandescent

Roof-top, open-wiring feeders at Buick are being torn down. New feeders will be enclosed bus duct inside the building for secondary system; conduit for primary.

lighting for storage purposes. Another plant area, used for tank parts storage during the war, is now a body spray and slush polish line, requiring the installation of paint spraying and ventilating equipment and high intensity lighting. Another war storage area is now the "cut and sew" department for the manufacture of automobile upholstery. Here again, power distribution and high intensity lighting had to be installed. Other department revamping was along similar lines.

Power service at Fisher also received considerable attention. Ten new, 150,000 kva. interrupting capacity, 600-amp., 5,000-volt circuit breakers are to be installed at the main primary switch house to improve dependability of service throughout the plant.

Improved Lighting Installed

Lighting intensities were boosted where it was considered expedient to do so and the entire electrical system was carefully checked and put in A-1 operating condition.

While Fisher's plant electrical maintenance crew of some 40 men were busy reconditioning electrical equipment used during the war and unpacking items stored during that period, Riggs Distler & Co., electrical contractors from Baltimore, Maryland, were rushing to completely revamp the electrical system to meet the civilian production requirements. Peak crew for the contractor was 398 electricians.

That is what reconversion—from the electrical angle-meant in just two plants. Add to this the activities in all of Detroit's automotive plants and those throughout the country and you have a slight insight into the task that one of the nation's largest industries faced when V-J Day came. For some, of course, the problems were not so numerous-particularly those that continued to produce military vehicles and automotive parts during the war. Other companies had brand new plants built adjacent to the existing ones. In all, however, electrical rehabilitation was a significant part of the reconversion blueprint. And this holds true for practically all industries that have been and are now in such a transition stage.

How Much Will It Cost

STIMATING cost for motor installations is usually a "pain in the neck." There is always the question, "Who furnishes What and Why?". The estimator calls the architect for information on certain equipment. The architect says the company furnishing the equipment will have to be consulted and, as yet, that company has not been selected.

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Architects and engineers are as reluctant to supply preliminary figures as contractors, but doing so seems to be a necessary evil. "How Much Will It Cost?" is the question with which they are always being hounded. The owner starts asking it long before he has provided sufficient information to establish his installation requirements. The architect, in turn, is obliged to pass the question on to the contractor.

Electrical estimators have long since become reconciled to the necessity of starting with a limited amount of information, as a base, and fabricating a motor installation which will serve for estimating the job at hand. Seasoned estimators do this and the results are surprisingly accurate. A study of the things he must know in order to attain such ends really throws the spotlight on the vast amount of study and experience required before one can become an all around and proficient electrical estimator.

As the estimator studies the plans and motor listing, he mentally constructs the building, visualizes motor and starter locations, and reflects the possibilities of expeditiously handling equipment and prosecuting the work in general. In rapid succession motors are mentally classified as induction, slip ring, or synchronous; high, medium, low or variable speed; direct connected or free standing; ceiling, wall or floor mounted; and so on through the whole category of possibilities.

Having made such classifications, he proceeds to list additional motors which he knows are normally required for such a job. Fire pumps, sump pumps, fans, unit heaters, etc., are among those quite

PART IV

Giving spot figures on motor installation costs is a tricky business unless you have accurate finger-tip cost data. This fourth article in the series presents a table of installation costs for preliminary estimating use.

By Ray Ashley

Research Engineer Electrical Contractors Association of City of Chicago

commonly overlooked in preliminary listings.

Experience has taught him what he may expect to furnish in the way of standard and special materials. His labor cost records serve to establish labor costs for various working conditions. True, each job has its own peculiarities, but certain costs can be established to serve as a gauge for readily estimating most motor installations. Previous articles related how tables could be prepared for quickly estimating services, feeders, and distribution equipment. The accompanying tables for motor installations were worked up in a manner similar to that previously described for other sections of a wiring installation.

Table Headings

The reader may wonder why the column of contractors' sell units (costs

plus all mark-ups) is headed "Total-Estimated Cost," instead of "Sell Unit" as in other tables. This change in heading was made to accommodate a demand on the part of contractors for a table which could be distributed among engineers and buyers. It was felt that the heading "Estimated Cost" would get a better acceptance.

It seems advisable to digress briefly from the main topic in order to forestall adverse criticism of the practice of supplying such material to owners' representatives. A long story could be written on the subject but, to conserve space, three blunt statements may serve to establish the justification for doing it:

1. There is nothing detrimental in having lists of substantial base "sell units" in the hands of honest architects and engineers.

2. Other businesses benefit by supplying customers with base prices.

3. Experience of contractors indicate that better relations are created by having tables of "sell units" available for clients to use for preliminary estimating and checking purposes.

Architects and engineers are just as anxious as anyone else to prepare sound and dependable estimates. To do this, they must have a sound basis for estimating. The electrical contractor is the logical one to help them get started on the right track. Regardless of arguments to the contrary, an honest contractor has all to gain and nothing to lose.

The Tables

In preparing the accompanying tables, an effort has been made to include such labor and materials as are ordinarily required for industrial installations. The estimates were based on the following general assumptions:

- 1. All motors and starters furnished by separate contract.
- 2. Motor disconnect switches supplied by contractor.
- 3. 50 ft. (net) rigid steel conduit for each motor, with necessary conductors.
- 4. Four elbows for each motor (Conduit 1 inch and larger).

- 5. Fittings for motor connections are included
- 6. Special motor terminal heads for all motors requiring No. 3/0 and larger
- 7. Moderate allowance for mounting frames. (\$2.00 for 1 hp. up to \$14.00 for 100 hp., 220 volt motors-price includes labor for fabrication.)
- 8. All of the conduit is to be run exposed on ceilings and walls.
- 9. Installation in concrete building with 12 ft. ceiling.
- 10. Inspection permit fee (60 cents per motor plus 10 cents per hp.) is included in the price.

The Sell Units

The last three columns, under the heading "Division" are the contractor's sell prices for setting motor (labor), wiring and connecting (labor), and material, respectively. The sum of these three is shown in the column headed "Total" and represents the contractor's sell price for the complete installation. the motor is to be set by others, the unit other labor to permit easy adjustment, in case the work is to be done by others.

The unit for a complete installation of a 10 hp., 220 volt motor is \$105.50. If the motor is to be set by others the unit would be \$23.00 less or \$82.50. To this amount would have to be added the cost of any time spent with other mechanics who actually set the motor. This same amount would be arrived at by adding the last two columns-Wiring and Connecting-labor \$42.50 plus material cost \$40.00 or a total \$82.50.

Using the Table

Results are secured quickly by using the table as follows:

Example I

(Complete Installation)

Specification: Motors to be wired, set and connected include 2-10 hp., 3-25 hp. and 1-50 hp. units.

ESTIMATE

Using units from "Total" column of the table.

2-10 hp. @ \$105.50 = \$211.003-25 hp. @ 185.00 = 555.00 1-50 hp. @ 324.00 = 324.00 Contractor's Sell Price \$1,090.00

Example !!

Motors set by others

in Example I except motors to be set by others.

ESTIMATE

Using units from wiring and material column only.

2-10 hp. @ \$82.50 (105.50 - 23.00) = \$165.003-25 hp. @ 139.50 (185.00 - 45.50) = \$418.501-50 hp. @ 254.00 (324.00 - 70.00) = 254.00Total* \$837.50

*Add to estimate the cost of time spent with other trades.

Base Costs

It is generally desirable to have base costs included in the tables but, to avoid the confusion of too many columns, they were omitted here. The base costs can be quickly determined by multiplying material by 10/11 and labor by 100/-151.8. Very little error would be introduced if a multiplier of 0.91 was used for material and 0.658 for labor.

Example III

Problem: Find the base cost of installing a 10 hp., 250-volt motor.

Solution: Use above multipliers with the material and labor units in the table.

Labor to set $0.658 \times \$23.00 = \15.13 motor Labor for wiring and connecting $0.658 \times 42.50 = 27.97$ $0.91 \times 40.00 = 36.40$ Material \$79.50

Less inspection—(60¢ per motor plus 10¢ per hp.) 1.60

TOTAL BASE COST \$77.90 (No mark-ups included)

To check the base costs on the motor wiring sheets of a conventional estimate, the simplest method is to use the table units for extensions and apply the multipliers to the totals.

Example IV

Problem: Check base cost of installing following motors listed on a conventional estimate: 10-2 hp., 20-15 hp., 1-60 hp. units (set and connected by contractors). Solution: Use Table labor units for setting, wiring and connecting motor.

Labor cost 10- 2 hp. @ \$36.80 (9.00 + 27.80) = \$368.0020-15 hp. @ 89.00 (36.00 + 53.00) = 1780.001-60 hp. @ 209.00 (91.00 + 118.00) = 209.00

Total labor cost to customer \$2357.00 Base labor cost $(0.66 \times 2357.00) = 1555.62 (A) Material (Including inspection) Use table material units.

10- 2 hp. @ \$18.20 = \$189.00 20-15 hp. @ 49.00 = 980.00 1-60 hp. @ 175.00 = 175.00

Total material and inspection \$1337.00 cost to customer Base cost Material and Inspection $(0.91 \times 1337.00) =$ \$1916.67

Less inspection (31 motors @ 60¢ plus 380 hp. @ 10¢) = 56.60

\$1160.07(B) **Base Material Cost** Total \$1555.62 Base Labor Cost (A) 1160.07 Base Material Cost (B) \$2715.69 Base Cost of Job (No mark-ups included)

For the same installation, with motors set by others, the labor would be:

Use Table labor for wiring and connecting only

10— 2 hp. @ \$27.80 = "4" \$278.00 20—15 hp. @ 53.00 = 1060.00 1-60 hp. @ 118.00 = 118.00 \$1456.00 Base labor-(0.66 X

\$960.96 \$1456.00) = Set up on paper this looks like quite a ceremony, but the average estimator with his short cuts and a slide rule, could soon cover the ground. The labor check

would be close enough if 1 were subtracted from the unit price. Again the material prices secured by deducting 10 percent plus the inspection allowance, would serve for check purposes.

Special Equipment

The tables will cover the majority of alternating current motors encountered in the ordinary installation. However, the estimator must be on the alert for special equipment and installation requirements. Allowances will have to be made for such items as snychronous, slip-ring and slow-speed motors, and special control equipment. One of the most common "Jonahs" in estimating is slip-ring motors. It is so easy to overlook the additional wiring required.

Extra Allowances

When preparing the final prices for a preliniary estimate, allowances must be made for the following:

- 1. Motors which may have been overlooked in the preliminary listing.
 - 2. Increased cost of labor due to
 - (a) high ceilings
 - (b) cutting through walls and floors [Continued on page 186]

Specifications: Same installation as

MEDIUM SPEED MOTORS A.G. 3 PHASE

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MOTOR DATA & INSTALLATION COSTS COSTS INCLUDE WIRING (MAT. & LAB) FROM DIST. PAN. TO MOTOR BASED ON 50FT CONDUIT RUN

FOR PRELIM. FIELD ESTIMATING

DATA WIRING DATA				MOTOR	C O S T S (PER MOTOR)						
				SIZE	CONTRS!	TOTAL	NOTE	DIVISION			
CONDT.	WIRE (CODE SIZE)	MOT. SW. (FUSED)	STARTS. FUSE AMPS.	RUNNING LOAD AMPS.	H.P.	ADJ.PRICE	EST. COST (MARKUP INCL SEE NOTE)	(MARKUPS USED)	SET MOTOR	WIRING B CONN.	MAT- ERIAL
0.227		•	A.L. C		VOLT	MOTORS					
1/2"	14	30	102030	1 2 3 3 6 9	1103		55.00		9.00	27.80	18.20
1/2	12	60	40	15	5		69.50	-	15.00	31.00	23.50
3/4	10	60	60	22	7 1/2		79.50	TURN	19.00	35.00	25.50
3/4	8	100	70	28	10		105.50		23.00	42.50	40.00
1 1/4	6	100	80	40	15		138.00	e e	36.00	53.00	49.00
1 1/4	4	200	110	52	20		162.00	G E O	39.00	59.00	64.00
1 1/2	2	200	150	65	25		185.00	20	45.50	66.00	73.50
11/2	1	200	175	. 77	30		206.00	£ +	53.00	73.00	80.00
2	00	400.	225	102	40	+	28 1.00	N.OH	56.00	88.00	137.00
2	000	400	250	128	50		324.00	ER.	70.00	101.00	153.00
21/2	0000	4 00	300	150	60		384.00	S 50	91.00	118.00	175.00
2 V2	250 M.	4:0.0	400	190	75		427.00	% F0	118.00	122.00	187.00
3	400 M.	600	500	250	100		589.00	0 8	154.00	158.00	277.00
								38			
			71212		O AOT.	MOTO	DRS	100			
1/2	14	30	10 15 15	2 3 5	1 TO 3		61.75	COS	9.00	28.00	24.75
1/2	14	30	20	7.5	5		71.00	KET P203	15.00	31.00	25.00
1/2	14	30	30	- 11	71/2		75.00	HR. +	19.00	31.00	25.00
1/2	12	60	35	14	10		88.50	P R R	23.00	36.50	29.00
3/4	8	60	50	20	15		113.00	00	36.00	4 1.00	36.00
3/4	8	100	65	26	20		134.00	PRIC T \$1.	39.00	47.00	48.00
11/4	6	100	70	32	25		160.00	7 4	45.50	58.00	56.50
1 1/4	. 4	100	80	39	30		175.00	ATERIA PRICED	53.00	62.50	59:50
1.1/4	4	200	.110	51	40		208.00	A P P	56.00	70.00	82.00
11/2	2	200	125	63	50		247.00	MOB	70.00	86.00	91.00
11/2	1	200	150	75	60		285.00	LA	91.00	94.00	100.00
2	0	200	200	90	75		338.00		118.00	106.00	114.00
2	000	400	-250	123	100		468.00		154.00	130.00	184.00
21/2	0000	4:00	325	155	125		520.00		168.00	147.00	205.00
21/2	25 O M	400	375	180	150		57 1.00		182.00	170.00	2 19.00
3	400 M	600	500	240	200		767.00		204.00	233.00	33 0.00

NOTEFOR PRELIM. EST. WHEN EXACT LOCATION OF MOTORS IS NOT GIVEN, EST. AS FOLLOWS:FOR PRELIM. EST. WHEN EXACT LOCATION OF MOTORS IS NOT GIVEN, EST. AS FOLLOWS:(1) ESTABLISH SERVICE & DIST. GOSTS BY USING UNIT GOSTS PERF. FOR CONDT. & WIRE AND ADDING COST OF DIST. & PR. GENTER CTS.
(2) FOR BR.WIRING (PR. CENTER TO MOTOR) & MOTOR INSTALLATION, USE \$5.00 FOR EA.MOTOR PLUS \$5.00 PER. H.F. CONN. LOAD.

ELECTRICAL CONTRACTORS' ASS'N. OF GITY OF CHICAGO

Lighting Techniques for Proper selection of light sources and lighting equipment for correct color quality From Equipment for correct color quality

Proper selection of light sources and lighting equipment for correct color quality and lighting result in Food stores are basic factors in this planned lighting discussion.

By Berlon C. Cooper

TORES which sell food are, on the average, very poorly lighted. Little has been done to make use of *light* in selling this class of merchandise. A quick survey in several eastern communities showed that not over one store in ten had a *lighting result* which might be judged as average, in the light of today's lighting trend in other fields.

Food stores embrace a fairly wide range of markets. Some of the large chains have super-markets—large stores with specialty departments. These stores are usually arranged on a "serve-your-self" basis, pay as you exit. Some municipalities also have public markets, or large super-markets, comprised of individual stalls in one huge area. Here individual merchants lease one or more stalls. These markets make it convenient for customers to buy all their food requirements in one building, thereby saving much time and transportation. Other classes of food stores include the

neighborhood grocery store, delicatessen, bakery, meat market, fruit, and candy store. Of these, the candy store has been the most progressive generally in lighting.

The need for good illumination in food stores is readily apparent. It will contribute to the store's general appearance. It will suggest cleanliness. It will enhance the appetizing appearance of the products displayed, especially if the lighting is carefully selected from the standpoint of color quality. It will increase sales, by attracting new customers, and by increasing the sales per customer.

The physical size and shape of food stores varies greatly. The delicatessen or community bakery may be a very small store occupying as little as 150 square feet of floor area. Super-markets may occupy 40,000 to 80,000 square feet. Store layouts, display counter and wall case designs, types of refrigerator cases

used, checking and wrapping counter arrangements, also vary considerably. Thus each store presents an individual problem in *planned lighting*, and should be so considered.

The first step in planning the lighting for a food store is to decide what the lighting result of the particular store under consideration should be. This will include the entrance, or store front lighting, general interior and storage area illumination, and special lighting applications for feature displays, wall and floor cases, and refrigerated cases. The lighting of all these areas should be planned in such manner that they complement each other and present a harmonious appearance in the store when viewed as a whole. Furniture and store fixture layout and grouping should be known, in order to fully utilize the many types of special lighting appli-

Color quality of the illumination for each specific lighting problem within the store is controlled through proper selection of the light source. Fluorescent lamps of the 3500° white type, or incandescent lamps 200 watts and larger, are suitable for general illumination throughout the store. Incandescent

Fig. 1—Localized lighting in refrigerated cases accents the display. Fluorescent lamps are used in cases and to provide light for luminous signs in background.



Fig. 2—Fruit stand in D'Agostino Bros. grocery, New York City, is highlighted with 40 watt 3500° white lamps. The top row of lamps also lights the luminous signs.



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lamps are suitable for show window and store entrance lighting when used with or without color attachments. Color lenses are used to create spectacular and attention-compelling effects. Vegetable bins can be cooly illuminated by 4500° white fluorescent lamps which will accentuate the crisp freshness of green vegetables. Soft white fluorescent lamps are desirable for lighting displays of meats, fish and fowl, and show this class of food to the best advantage by accenting the red in the meats. Colored fluorescent lamps which harmonize with paint colors used on side walls or furniture within the store can be used to light translucent signs. Incandescent spot lamps provide ideal color quality for feature displays which are highlighted.

Store Front Lighting

All-glass store fronts, which permit full view of the store interior, are becoming more popular. Whether new and remodeled stores use show windows or follow the trend to all-glass fronts, reflector spot lamps recessed flush in the ceiling near the glass line in proper size and on spacings to provide 100 to 200 footcandles, will serve to attract passersby to the store, and to the dis-

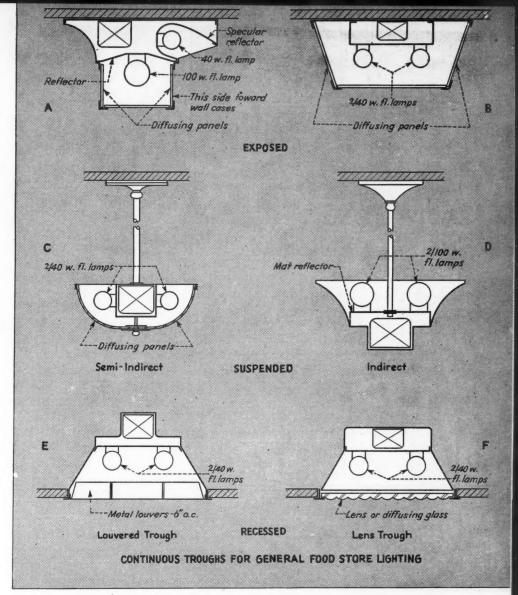


Fig. 3—Continuous troughs installed on correct spacings for uniform illumination provides ideal lighting for food markets. Type A unit should be installed four to six feet from wall with open reflector towards wall.

plays within. Show window reflectors, or prismatic glass lens units, using standard lamps, may also be used efficiently to provide this high intensity lighting. The location of the store with relation to other stores, theatres or brightly lighted attractions will deter-

mine whether the front of the store under consideration should be 100 footcandles, or higher.

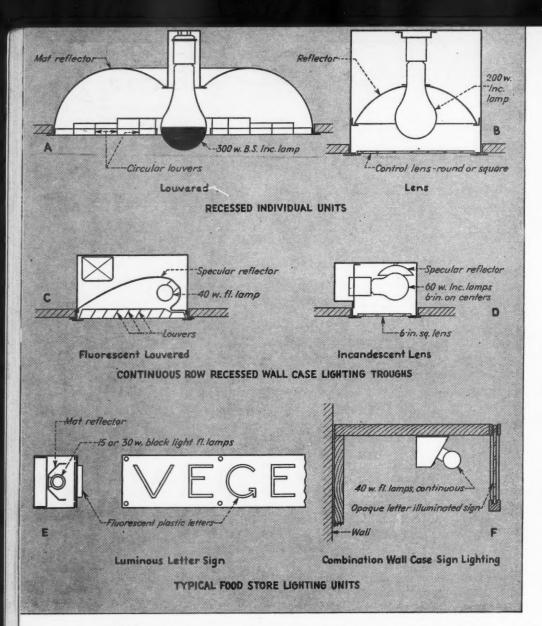
General Store Lighting

A uniform intensity of general illumination should be planned for the entire store interior. An intensity of 25 footcandles is recommended for neighborhood stores, and of 40 to 50 footcandles for stores located in business districts where other types of stores compete for the buyers' attention.

The shape of the store, its structural and architectural features, will guide to some extent the selection of the lighting units or equipment selected to

Fig. 4—Fluorescent soft white lamps in this refrigerated meat case furnish diffused lighting of proper color quality to display the meats to best advantage.





provide general lighting. Lighting units or equipment suitable for general lighting may be classified as follows:

- A. Continuous row equipment
 - 1. recessed
 - 2. surface mounted
 - 3. suspended
- B. Individual units
 - 1. recessed
 - 2. surface mounted
 - 3. suspended
- C. Indirect lighting
 - 1. from coves
 - 2. from wall urns or floor pedestals
 - 3. from tops of wall cases

Of the above types, continuous row equipment and individual units will be found to be practical for most types of stores. Indirect lighting for general il-

Fig. 6—White light from 4500° fluorescent lamps accentuates frozen food refrigerated cases. One row of lamps is installed at the top of the mirror behind the open top refrigerator, and another row at top of case, behind the luminous sign.

lumination is generally suitable for small stores, especially fruit and candy stores, and bakeries, where an unusual artistic decorative treatment is desired. Continuous row equipment can be used effectively to subtly direct store traffic, whether recessed, surface mounted or suspended. It is also well adapted to new light sources, such as the standard and long slimline fluorescent lamps. Fully recessed equipment, either continuous row or individual units, have the advantage of creating an air of spaciousness

Fig. 5—Individual recessed units, spaced for uniform lighting, permits spacious and clean appearance of store interior. Types C and D units, recessed in ceiling parallel with wall cases, provide high intensity lighting for merchandise on wall case shelves, Luminous fluorescent plastic letters in individual signs are new, highly visible, and individual in appearance. Type F shows detail of lighting sign and shelf merchandise from same lamp, as in Fig. 2.

within the store, and of producing more footcandles from a given number of lamps.

Diffuse and uniform illumination from a semi-indirect or totally indirect lighting system is free from shadows, and creates a dignified atmosphere. When this type of lighting is used, feature displays can be made to stand out effectively by highlighting with incandescent reflector spot lamps, concealed in the suspended trough or in the ceiling.

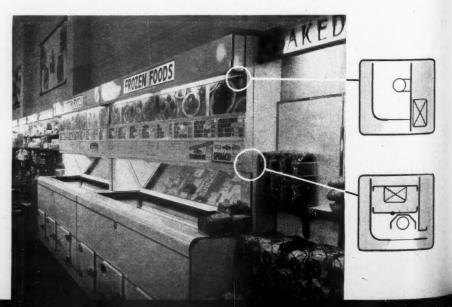
Spacing of individual units, either fluorescent or incandescent, should not exceed the mounting height of the units above the floor. Closer spacings are desirable, in order to provide a uniform level of illumination at the display line. Modern architectural treatment and general lighting trend calls for planned lighting for each lighting problem, even within the same store, so that there is less demand for surface mounted or suspended individual units.

Special Lighting Applications

There are many lighting problems in each food store which can best be solved with some special type of lighting units. They include the lighting of wall and floor cases, feature displays, fruit and vegetable bins, refrigerator cases, signs, display niches, and similar locations.

Wall display cases, filled with items of various sizes, shapes, colors and tex-

[Continued on page 185]



Analyzing Overhead

Overhead percentage variations related to job costs and annual rates, a new approach to markup methods on electrical construction estimates.

By A. C. McWilliams

Chairman, Committee on Analysis of Operating Costs Electrical Contractors' Asso. of City of Chicago

VERHEAD is the cost of operating a business. It covers executive salaries and desk blotters, entertaining and window washing, plus a host of other large and small expenditures for a hundred or more products and services. It is the means by which a business is enabled to serve its customers. It is the cost of services that are not directly chargeable to the job.

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Since a large share of electrical construction work is priced by lump sum bids, a methodical system for allocating overhead costs to individual contracts is essential if predicted profits are to be realized. It is not uncommon to find a contractor who turns out a detailed and highly accurate estimate up to net cost,

then adds a wholly arbitrary item for overhead or a flat percentage for overhead and profit together. It is no more realistic to pay overhead out of the estimated profit than panelboards or payrolls. An accurate cost estimate deserves an accurate markup for overhead.

A critical study of overhead and its relation to the size of each job is under way in Chicago. It is a joint project of the Electrical Contractors Association and the Electrical Estimators. Substantial progress has been made in the analysis and this article will outline some of the high spots of the study.

As a preliminary to the study of how overhead should be allocated by job size, an analysis was made of overhead averages based upon annual volume of business. A number of such studies have been made in the past and further data were readily available from the contractors who cooperated in this project. The average percentages in this instance, however, were based upon annual volume of cost including material, labor, insurance, and other direct job expense, except engineering and estimating.

The total percentages were built up from four categories of overhead costs, (1) office, travel, promotion and miscellaneous expense, (2) management salaries, (3) salaries for office help and store room, (4) estimating and engineering.

From a base of a 1 million dollar total annual cost, overhead costs show a moderate percentage increase as volume drops to the \$300,000 level, from 15.8 percent to 19.8 percent. As annual volume drops below the \$300,000 level, however, the percentage rises rapidly, to about 32 percent at the \$50,000 level.

At the \$1,000,000 volume level, the percentage for estimating and engineering stood at 3 percent, nearly four percent at the \$300,000 level and 6 percent at the \$50,000 level. Salaries for office help and store room changes less in the upper levels but rises steeply as volume

AN IMPORTANT STUDY

The subject of overhead is one that deserves the most careful attention and analysis in the days ahead. This is a period of transition. Business methods are going through a radical change. There is much talk of going back to "normal" times now that the war is over, of returning to "normal" business. Those who are building plans in that direction are likely to wake up one day to find that the world has passed by. Actually, the industry must move ahead to new horizons, new methods and new problems. And the overhead practices of the coming months can have an important effect on industry progress.

In bad times we consider overhead as an unmitigated evil to be sliced and pared from every angle, to be reduced to the absolute minimum of a roof and a shingle. In better times, we keep it cautiously trimmed with a wary eye on the competition. During the past several years it has received slight notice, if any, beyond essential accounting. Yet to enter the period ahead without at least a basic overhead policy is to risk a serious management failure.

Overhead phobia and an overcautious policy can, for instance, stifle sales promotion at a time when a favorable competitive position is far less important than creative market development. It could inhibit the development of engineering services when industry and commerce are seeking intelligent and competent counsel on everything electrical. It could prevent the develop-

ment of good-will building services when people are sick and tired of doing their own electrical repairs. With what appears to be a boom period ahead, it is of extraordinary importance that overhead structures allow ample play to the creative services which not only build business but raise the standards of the whole industry.

The accompanying article and charts prepared under the direction of A. C. McWilliams, Chairman of the Committee on Operating Costs of the Electrical Contractors Association of the City of Chicago, is a study made by that association with the cooperation of the Electrical Estimators group of the same city. It is by way of an interim report but important enough in our opinion to present as it is now because of the guidance it can provide for other contractors over the country.

The figures presented are "average percentages" based upon past experience. They cannot, of course, predict what future conditions may bring. If the industry is headed toward a mature stability, overhead costs will tend downward. If, on the other hand, it is headed toward aggressive market development and an expanding role in the economy, the costs will tend to head upward. But these are problems pretty much up to individual managements who must make important decisions in the months to come. The Chicago data, in any case, can provide guide lines and reference points of great value.—Editor.

PANEL 1

Overhead percentage variations based on annual volume of net cost.

Annual Volume Dollar Cost of Material, Labor and Job Expense	Estimating and Eng.	Sal. for Office Help & Store Rm.	Management	Office Travel, Prom. & Miscl. Expense	Average Total Overhead Percentage	
50,000	6.	8.	8.	10.	32.	
75,000	5.	6.5	7.	8.8	27.3	
100,000	4.6	5.7	6.4	8.	24.7	
150,000	4.2	5.	5.7	7.2	22.1	
200,000	4.1	4.75	5.2	6.75	20.8	
300,000	3.95	4.5	5.	6.4	19.9	
400,000	3.8	4.25	4.9	6.1	19.1	
500,000	3.6	4.	4.75	5.9	18.3	
750,000	3.2	3.75	4.4	5.5	16.9	
1,000,000	3.	3.6	4.	5.2	15.8	

Note: Percentages shown assume normal business operation.

PANEL 2

(1)	\$10,000 base cost	60 per cent material		40 percent labor		
	7.	5% of \$6,000	\$450			
	26.	2% of 4,000	1048			
		Total	\$1498			
	Job Overhead		15	%		
(2)	\$10,000 base cost	30 percent material		70 percent labor		
	7.5	5% of \$3,000	\$225	4		
	26.	2% of 7,000	1834			
		Total	\$2059			
	Job	Overhead	20.6	%		

drops below \$200,000, at \$1,000,000 it is 3.6 percent, at \$300,000, 4.5 percent and at \$50,000, 8 percent. Office, travel, promotion and miscellaneous follow a similar curve. Starting at 5.2 percent on the \$1,000,000 volume, it increases to 6.4 percent at \$300,000 and up to 10 percent at \$50,000.

Management salaries proved to be the widest variable between individual firms. However, the figures used represent a fair average of normal practice. The percentage at \$1,000,000 level is 4 rising to 5 at the \$300,000 level and to 8 at the \$50,000 amount. In companies where the manager also performs some of the engineering or estimating functions, the salary is, of course, pro rated between the two categories.

The study showed, however, that the size of individual jobs was a more significant variable in establishing overhead percentages than annual volume. Percentages based on annual volume vary widely from the average in individual companies. The variation from the average when individual job costs are used as the base was found to be small.

This is a logical result since a firm handling six \$50,000 jobs in one year would have substantially lower overhead and sales costs than one handling 300 individual small jobs averaging \$1000 though the total would be the same.

When we refer to job cost overhead in this study, we are primarily concerned with conventional new construction work involving the usual conduit, wire, switches and similar electrical construction materials. Where large quantities of equipment, such as motors and control apparatus, or fluorescent lighting equipment are included, these items are usually separated and treated as a straight merchandise sale at the prevailing resale prices. This is particularly important where the contractor must meet competition from other dealers or sell at established list prices. When a contractor quotes on such items in connection with other work and applies a flat job overhead, he appears out of line with competition that has to include only the lower overhead markup of a straight merchandising operation, whereas, with a proper distribution of overhead over

the work his price would be competitive, he could make a small margin of profit, and retain the good will of his customer.

Our study is based upon jobs which are divided on the ratio of 60 percent material and 40 percent labor. The proportionate overhead to material and labor is shown on the curve. The combination of these two overhead percentages determines the total overhead.

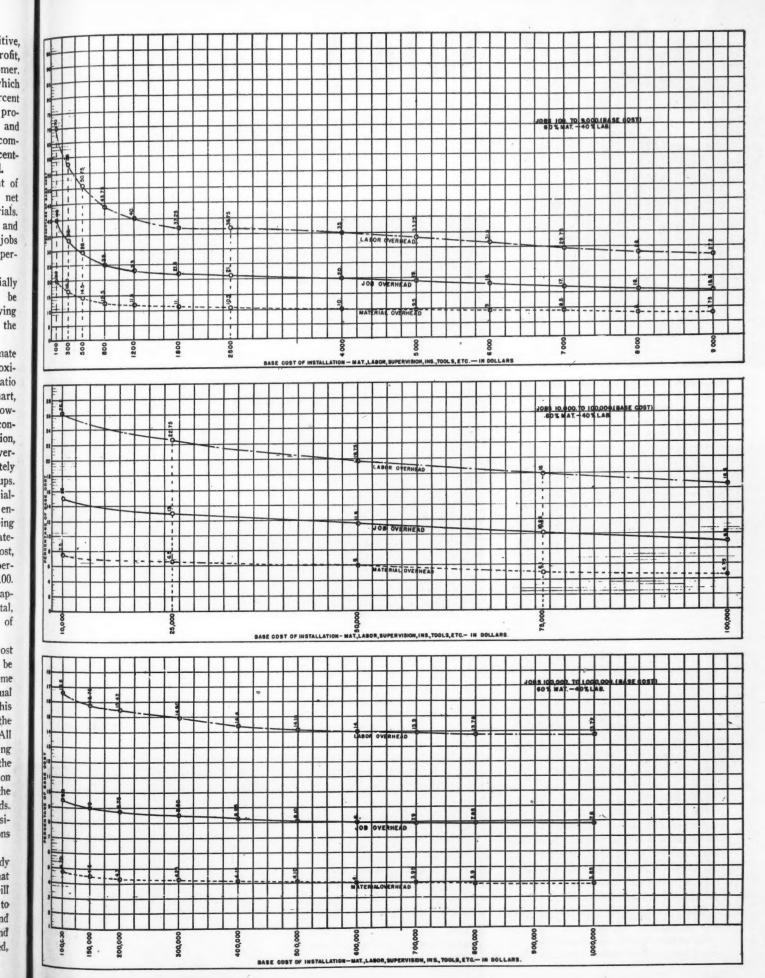
Costs relating to the management of labor are higher with respect to net cost than those relating to materials. The study shows this relationship and the resultant job overhead where jobs run at a 60 percent material to 40 percent labor ratio.

Other ratios which are substantially different from this average can be treated just as methodically by applying the labor and material markups to the respective cost totals separately.

As a typical example, an estimate totalling \$10,000 base cost with approximately a 60-40 material-labor ratio would require, according to the chart, a 15 percent overhead markup. If, however, the material-labor ratio varied considerably from this average condition, the labor overhead and material overhead figures may be applied separately to arrive at the appropriate markups. For example—let us assume a materiallabor ratio of 30-70 as might be encountered in a change-over job invloving the re-use of much of the existing mate-Taking the same base cost, \$10,000, the labor overhead of 26.2 percent applies to 70 percent or \$1834.00. The material overhead, 7.5 percent applies to 30 percent or \$225.00. The total, \$2059.00, is an overhead markup of 20.59 percent on the base cost.

Percentages developed on base cost of individual jobs should, of course, be adjusted in individual cases to come within the range of the average annual overhead of the contractor based on his own annual volume of business and the kind of work he normally handles. All of the figures shown presume a going organization set up for handling the particular job which he is analysing on a highly efficient basis according to the best and latest practices and methods. Further, there is no allowance for business slumps or other abnormal conditions which may affect overhead costs.

There is still room for further study on this whole subject and it is hoped that other organizations and individuals will bring their experience and insight to bear upon it. Without a clear and accurate picture of overhead costs and their relation to each job estimated, profits are only hopes.



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Dangerous welding practices. This operator is using an uninsulated electrode holder and the cables coiled carelessly under his feet and legs may trip him when he rises.

Dangerous welding practice. Arc-welding operator should be particularly careful when working above the floor or ground, since many fatalities are caused by falling.

Safety Factors

By R. F. Wyer
Application Engineer
Electric Welding Division
General Electric Company



THERE is one peculiarity which distinguishes the arc welding operator's job from other occupations. Arc welding is the only widely practiced industrial occupation in which the operator handles a live electric circuit all day, yet, in spite of all the implications of that fact, the danger of electric shock to the operator is not as great as is often supposed.

The arc welding operation does involve some fire hazards, as well as the ordinary mechanical hazards to the workman which are common to almost any industrial occupation. But these are not peculiar to arc welding. The presence of fumes and smoke is likewise not peculiar to the arc welding process, and ordinary means of dilution and removal are employed.

Radiation of ultra-violet and infra-red wave lengths from the arc are sometimes

regarded as serious hazards. They are not, however, since their effects can easily be prevented by commonly used protective helmets and clothing.

The hazard of electric shock is probably one of greatest interest and merits detailed discussion of good and bad practices which in the final analysis determine to a large extent whether or not the occupation is really hazardous. It is not as common a source of injury or death as might be supposed from casual acquaintance with the subject.

The shock hazards which do exist might be classified as to their relationship to equipment and its layout, maintenance, supervision, and operator education.

Dangerous welding practice. The insulation of this electrode holder is broken.

Electrical Contracting, January 1946

Seeing atomic hydrogen arc welding equipment in operation brings up the perpetual question as to the relative hazard in a-c and d-c welding. Here, there is at times a potential of 300 volts between the two slender electrodes projecting up and to the left from the



IN ARC WELDING

Arc welding is not a hazardous occupation in the usual sense of the word but much can be done to eliminate many dangerous practices.

arc. It is alternating-current. No case of severe shock, and no fatalities resulting from the use of this equipment, have ever come to our attention.

The point is made to demonstrate the fallacy of arguments, based on clinical or laboratory experience, as to the difference between a-c and d-c welding with respect to shock hazards. In this equipment an adequately insulated electrode holder is used, and factory designed and built protective equipment disconnects the power when the arc is not actually in use.

Exhaustive studies on let-go currents, made at the University of California, definitely prove that under laboratory conditions, a victim is less likely to freeze onto an electrode with d-c than with a-c, at a given current in milliamperes. But to draw the conclusion that d-c welding is invariably safer than a-c welding is to ignore the factors of voltage, insulation, protective equipment, skin resistance, and physical condition of the subject. The extremes to which interpretations of these tests may go is indicated by the recent development of a theory, by a welding supervisor, that while 24 volts is safe, 28 volts is danger-

With respect to the installation of arc welding equipment, the major safety point is the necessity of grounding the frame of the welding set, regardless of whether it is an a-c or d-c unit, or whether it is stationary or portable.

Common sense, as well as the National Electrical Code, demand that this should be done. An ungrounded unit, even one in perfect condition, can give annoying shocks and tickles to a grounded individual, because of the inherent ability of an electrical circuit to induce a static charge on another conductor separated from it by insulation. The effect is the same as that in a condenser, or Leyden jar.

In the event of failure of the insulation, due to age, abuse, or accident, the frame of a unit may become charged to full power circuit voltage, with serious consequences, unless the frame is grounded. If the proper ground connection is in place, however, the frame cannot have a voltage to ground, and the only effect of such a failure will be the blowing of fuses or tripping of circuit breakers and disconnection of the unit from the line.

This immediately suggests the necessity of installing adequate overcurrent protection and switches in the power circuit to the welder. Fuses or circuit breakers must be capable of interrupting the maximum current which may be drawn by a short circuit in the motor or power leads of a d-c welder, or in the primary circuit of an a-c welder. Disconnecting switches must be capable of interrupting the stalled rotor current of the d-c machine, or the maximum current which can be drawn by the a-c unit when the welding electrode is short-

circuited on the work.

On the welding-circuit side of a unit, care should be taken to avoid the possibility of getting double the normal circuit voltage between two adjacent welding circuits, because of the connection of one unit with one polarity, and the other with opposite polarity. On acunits, abnormal voltage of somewhat lower value can also be obtained if adjacent welders are operated from different phases of the supply line. This factor has rarely, if ever, caused serious trouble because of the small likelihood that an

[Continued on page 188]



Dangerous welding practice. Arc-welding operator should never sling electrode holder over his shoulder, nor leave an electrode in a holder not in



Dangerous welding practice. Electrode holder should never be thrown or placed where it can make contact with the conducting material.

BAKE OVENS FOR SILICONE VARNISHES

ANY manufacturers of electrical equipment, as well as service shops are using the new type of insulating varnish, called silicone varnish. Since the use of this material is certain to increase rapidly, a brief description of the baking cycle, the oven and the necessary controls, is opportune.

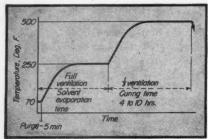


FIG. 1—Time-temperature curve for typical two-stage silicone varnish baking. Entire cycle is automatically controlled.

The chief engineer of an industrial oven manufacturer discusses the baking cycle and oven requirements necessary for baking rewind jobs impregnated with silicone insulating varnish.

As its name implies, silicone varnish is a product obtained by replacing some of the carbon atoms with silicone. Carbon, oxygen and hydrogen are retained for chemical versatility in liquefaction and control. Substitution of silicone, or sand, gives a new molecular structure with one characteristic not present in former organic varnishes, namely high heat resistance.

The temperature limitation of the inflammable organic insulators is well known. Since silicone varnish is capable of doubling the resistance to high temperatures, obviously for such applications it should be combined or bonded with glass or mica or similar tapes and separators.

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Silicone varnish is thinned in the conventional manner. It is applied by dipping or impregnating while still warm to insure complete penetration. The warmth is obtained from a preliminary drying out to completely remove all moisture.

The silicone varnish curing cycle is in two definite stages. The first consists of solvent evaporation at 220° F. to 275° F. for a sufficient length of time to remove all traces of solvent. This is very important since all solvent gases must be evolved before the varnish surface cures and hardens to avoid puncturing the surface and leaving uninsulated craters. The time factor depends upon the physical size of the parts being processed and the depth of penetration of the varnish.

During the solvent evaporation cycle, the oven should be adequately ventilated for safety. This means that sufficient fresh air for ventilation must pass through the oven to insure that the ratio of solvent gas to air does not exceed one percent by volume. In a batch type oven this is 350 cfm. of 70°F. equivalent air for every gallon of solvent in the charge. In a conveyorized oven-with counterflow ventilation, and with solvent evaporation and with removal along a predetermined portion of the conveyor travel-ventilation at the rate of 150 cfm. of 70°F. equivalent air per gallon of solvent is usually sufficient to prevent the formation of dangerous concentration of solvent gas.

The second stage of baking is at 450°F. to 500°F. for curing or polymerizing the synthetic varnish. The time will vary from 4 to 10 hours depending upon the absorption rate, which in turn is influenced by the physical proportions of the work being treated as well as the degree of varnish penetration. During

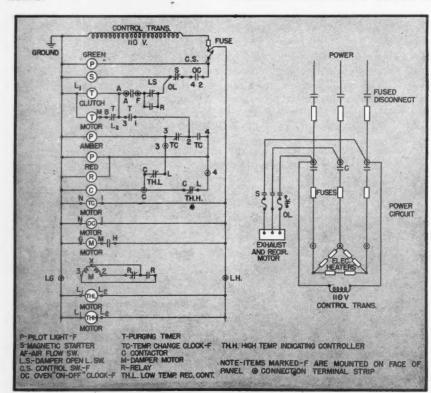


FIG. 2—Schematic diagram of entire control system for an electric bake oven. Gas fired oven has same control characteristics.

By P. A. Meyer Chief Engineer Young Brothers Co. Detroit, Michigan

this stage, with the solvent previously removed, a minimum of ventilation to insure smoke removal is sufficient.

Having reviewed the baking cycle involved, it is well to analyze the requirements of an oven to accomplish this process with minimum effort on the part of the operator. A typical gas fired batch type, or truck type oven suitable for production or service shops is illustrated in Fig. 3. A good bake oven should have the following requisites:

- 1. Even temperature distribution.
- 2. Automatic temperature control.
- 3. Well insulated structure with low thermal capacity.
- 4. Ventilation control.

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Uniform temperatures throughout a rather dense load are obtained by recirculating a large volume of air through the mass, creating a turbulent condition for air penetration to all surfaces, exposed or hidden. The quantity of recirculated air is determined by the energy input, and only indirectly by the oven volume. Repeated tests have determined that in order to give temperature differences within 10°F. throughout the baking zone for varnish baking at temperatures up to 500°F., the temperature potential should not exceed 30 B.t.u. per hour, or approximately 9 watts, per . cfm. of recirculated air. Electric heaters or gas burners are installed back of baffles on the side walls or inside the roof, the baffles preventing direct radiation.

For silicone varnish baking, two controllers are preferred, one of these to be of the recording type to give a complete record of every bake. Either two position "on" and "off" control or modulating control is acceptable, the latter being useful in handling larger energy volumes.

The oven structure consists of 22 gauge steel panels enclosing 4 inches of 12-lb. density rock wool or glass wool insulation. This construction has low radiation loss, and the light weight permits temperature changes to be made rapidly without accumulating an exces-

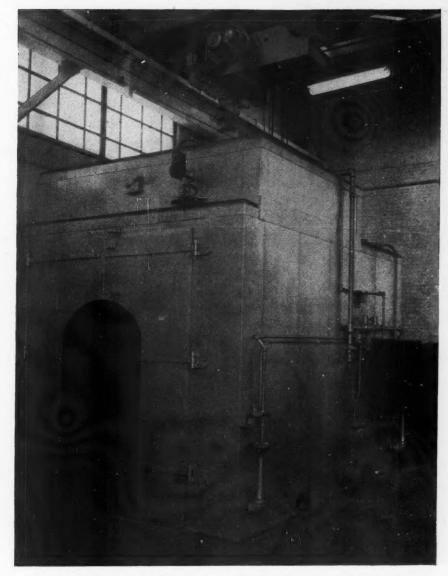


FIG. 3—Typical gas fired batch or truck type oven in an electrical equipment manufacturing plant. Control equipment is at right. Unit suitable for production or service shops.

sive amount of energy stored up in the oven walls. Dense refractories or brick construction are objectionable because of their heavy absorption of energy and high conductivity and serve no useful purpose at such low temperatures.

Underwriters and insurance companies will not approve a varnish baking oven unless the ventilation is positive and controlled by a centrifugal fan of ample capacity. Solvent vapors are explosive; if not diluted and removed a dangerous mixture will result in the oven. Gravity ventilation is variable to a great degree and influenced by outside winds, temperature, stack height and building ventilators. The positive pressure fan is the only means of overcoming these external influences to give a controlled safe ventilation. Since the ventilation at 500° F. may be reduced, the approved method is to use a separate

fan of reduced capacity, or a positively and automatically controlled damper in the exhaust stack.

Complete Automatic Control

Figure 1 is a typical two stage silicone varnish baking time-temperature control curve. The entire cycle functions automatically, after the initial setting, recycling for subsequent bakes.

To set the operating sequence for this control system the operator performs these operations:

- Sets "on-off" clock for the desired time the oven is to be started, day or night, and shut down at the end of the final bake.
- Sets the recording temperature controller for the solvent baking temperature, or 250° F.

[Continued on page 187]



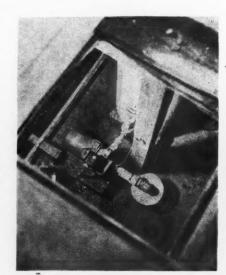
The sign of modern farming. This is the Motz' farm in northeastern Ohio where a research program has been established for the purpose of determining where electricity can make money for the farmer.

Joseph Motz on the 160 acre dairy farm he operates in Trumbull County, Ohio for 18 cents per hour that he formerly did by hand, thereby making it possible for him to devote the time saved to other income producing enterprizes. Typical of 85 percent of the farms in America that produce approximately half of the country's farm products, the Motz' farm is one of millions that make up the rural electrification market, the successful development of which means more prosperous farmers.

Westinghouse is very much interested in the development of the farm electrification program and has been closely associated with it for over 25 years. During this time the number of farms receiving "high line" service has grown from a few thousand to over 2,500,000 or to more than 43 percent of all the farms. This program has developed to the point that today both agriculture and the electrical industry stand at the threshold of a new era; the electrification of America's agriculture.

The many people of Westinghouse who have been following the electrification development of the farms are firmly convinced that electricity can do for agriculture the same that it has done for

industry; that farm electrification can make money, not only in raising the income, but through labor saving and lower production cost. These productive uses will also provide the electrical convenience that can contribute so much to better living on the farm.



Water under pressure for the drinking cups in the dairy barn and the cooling pit in the milk house is furnished by this deep-well, jet type of pump driven by a ½ hp. Westinghouse motor.

Electrical Contracting, January 1946

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How man-days are saved and earnings upped by farm electrification.

By W. D. Hemker

Supervisor, Rural Electrification Section Westinghouse Electric Corporation Pittsburgh, Pennsylvania

> With this idea in mind a research program has been established in cooperation with the Ohio Public Service Company and Joseph Motz, a farmer in the territory served by this utility. The purpose of this research project is to find out exactly where electricity makes money on the farm in order to be able to make definite recommendations from a background of actual experience. The Motz' farm did not have electric service prior to the setting up of the project. This made it possible to obtain complete records of doing chores and tasks on the farm and in the home without the help of electricity; consequently a comparison could be made of these various activities as they are electrified.

Cost account records are being kept by Mr. Motz and his family covering man-hours and production costs involved in carrying on their various activies. The Doane Agricultural Service Inc., of St. Louis, Missouri, one of the coun-

Bob Motz sharpening scythe blade. The 1/3 hp. Westinghouse motor and the grinder were the first pieces of profit-making equipment installed on the Motz' farm.



MELECTRIFICATION PAYS

try's leading farm management organizations, is supervising the collection of records and analyzing the results on a farm management basis. The Ohio Public Service Company is making time and motion studies of all farm work before and after the application of electricity.

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Mr. Motz is paying all power and equipment costs out of his income on a definite pay-as-you-go basis. This is one of the primary factors in the program; namely, to find out exactly where electricity, when properly applied, can pay for itself and make a good return to the farmer. In this way a farm can become completely electrified, over a period of years, including so-called convenience items with a relatively low initial investment.

In analyzing the records of the past year's activity some very interesting factors have been revealed. While it was not expected that this electrification project would show much of a profit until some major equipment had been installed, nevertheless, it did show a small profit in the first two months. Savings of \$17.57 were credited to electricity for doing farm tasks, which, after the electric service bill of \$10.92 was paid left a net operating profit of \$6.65. This profit was realized although Mr. Motz used only 46 percent of the power allowed by the minimum bill. The profit

Cooling milk on the Motz' farm is done with cold well water pumped into the cooling pit electrically. The milk is strained as it is poured into the can in the cooling pit.



TABLE I 1944 LABOR DISTRIBUTION AND PROFIT Per Cent Per Cent Hours of Contributed Of All Labor To Farm Profit Accounts Labor 46.5 12.7 3199 96.3 20.1 8.6 4.5 Wheat..... Oats...... Soybeans 1945 Hay 1945 Corn 1945 Wheat 1945 Oats Barn Capital Electric Pump...... Maintenance Improvements... Maintenance, Tractor, Machinery, TOTALS..... 100.0 100.0 6860

should be greater when the farm gets the benefits of increased use of electricity.

An outstanding example of possible savings in time and money through the use of a 1 hp. utility motor to operate a sickle sharpener during having season was revealed in these records. By actual comparison it cost but 3 cents for electricity and three man-hours to sharpen the sickle electrically on the farm for the entire season as against \$6.00 for machine sharpening in town and 10½ man-hours for touching up by hand on the farm. No time was charged against taking the sickle into town to be sharpened and of picking it up later as it was assumed Mr. Motz could do this along with other farm errands. Experience has proved however that an occasional special trip was necessary. Regardless, the direct saving amounted to \$5.97 cash plus 7½ man-hours per season. On this basis, the grinder could be paid for in three having seasons since it cost but \$15.30. From then on it would contribute to the over-all profit of the farm and the savings effected could be applied toward the purchase of other farm equipment. The motor is used to operate a fanning mill, a concrete mixer, a grinder to sharpen plow shares,

ensilage cutters and farm tools in addition to operating on the sickle grinder; therefore, its cost of \$17.50 is prorated over these operations. However, if its cost were added to that of the sickle grinder, both could be liquidated in less than six having seasons.

The analysis reveals that the dairy contributed only 26.3 percent of the farm profit, yet it consumed 46.5 percent of the labor. It further shows that the average production per cow was 5548 lbs. of milk and 266 lbs of butter fat which is below that considered profitable. In an effort to improve the efficiency of labor, a deep well pump and drinking cups were installed. This eliminated the time consuming job of pumping and hauling the water and watering the cows by hand during the 5 winter months, resulting in a saving of 175 man-hours for the 5 month period. The time saved can be used to take care of additional cows or to do other productive work.

The records show that it required 4.66 man-hours to produce 100 lbs of milk during January, February and March of 1944 when the cows were watered by hand and 3.80 man-hours during the same three months in 1945

[Continued on page 103]

BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

PRACTICAL METHODS

LIMIT SWITCHES USED AS CRANE CONTROLLERS

WIRING

Upsetter cranes in a forge shop have a tough duty cycle. Their prime function is to take stock out of the furnace, place it into a scaler, remove it and place it into the upsetter, remove it and return it to the furnace. Since the stock cannot be allowed to cool too much during this process, all these operations must be performed within the matter of a few minutes.

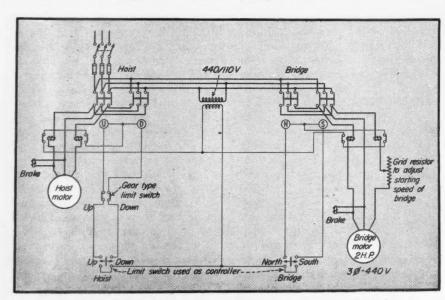
Normally, reversing drum switches are furnished as controls for both the hoist and bridge motors of these cranes. At the Dodge-Chicago plant of the Chrysler Corporation, it was found that these drum switches hampered the upsetter crane operator. The reversing action was too slow and there was too much lost motion. To solve this problem, the engineering department recommended—and had installed—conventional two-position limit switches in place of the drum switches.

The two switches are elbow-mounted to a Tee conduit fitting in the small cab of the crane. Conveniently adjacent to each other and equipped with lever

extensions (handles), these switches provide quick-action, finger-tip control of the hoist and bridge motors. The short travel-arc of the levers to make and break contact eliminates the lost motion inherent in the drum type of unit. More efficient crane operation and less operator fatigue resulted from this substitution and has enabled the operators to move stock from the furnace to a scaler and into the upsetter in considerably less time.



Compact limit switches mounted in this upsetter crane cab give quickaction, finger-tip control of hoist and bridge motors.



Wiring diagram illustrates the substitution of two-position limit switches for conventional reversing drum switches in the control circuit of this forge shop upsetter crane.

END MILL CLEANING OF SEMI-CLOSED SLOTS

INDUSTRIAL

Engineers in the Middle Atlantic District Maintenance and Repair Shop of Westinghouse, have evolved the method shown in illustration to clean old insulation and dried varnish from armatures after stripping.

Formerly a file was used to clean these slots; but since this method proved to be very tedious and laborious, a substitute method was sought.

A setup using an end mill with a recessed shank placed in an air drill proved to be quite successful; the shank is recessed so that the end mill can be moved freely in the slot. A girl now



Recessed shank permits end mill to move freely in armature slots for cleaning, resulting in time savings up to 90 percent

uses this method to clean armature slots with a savings of approximately 90 percent of the time formerly spent in doing this work.

This method may possibly be applied to other cleaning operations where space or the opening may be quite restricted. Since standard tools, which are readily available are used, cost can be held at a minimum.

SYLVANIA NEWS CONTRACTOR EDITION

JANUARY

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Published by SYLVANIA ELECTRIC PRODUCTS INC., Salem, Mass.

TWO NEW RESIDENTIAL FIXTURES, ANNOUNCED BY SYLVANIA, STRESS QUALITY AND SIMPLICITY

Home Fixtures Designed to Fill Big Demand Shown in Survey

The most recent additions to the long line of Sylvania Electric fluorescent fixtures are two new residential units-stressing

quality and simplicity.

These fixtures have been designed to fill the demand of millions of home owners, builders and decorators who plan to install fluorescent lighting. According to a recent, impartial survey made for Sylvania by one of the country's largest market research organizations, installations are planned by 11,931,000 families. A great many more installations are expected, now that these attractive fixtures have been designed especially for the home.

Here is an opportunity for electrical contractors to enter a vast new field for fluorescent installations. They will find the new Sylvania Electric residential fixtures adaptable to almost every home application. And, like Sylvania commercial and industrial fixtures, these new units are destined to become leaders in their field. Write to Sylvania, or see your local Sylvania distributor, for full information on the complete line of Sylvania fluorescent fixtures.

FACTS FROM THE RESIDENTIAL LIGHTING SURVEY

Of those who have fluorescent lighting:

30.4% plan kitchen installations

24.6% will install in the bathroom

15.2% will install in the living room

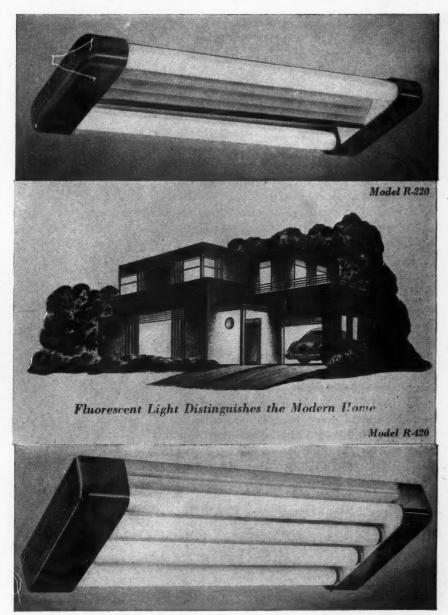
8.0% in the bedroom

Among those who have no fluorescent lighting:

64.4% plan kitchen installations 14.2% living room

9.1% bathroom

1.9% plan bedroom installations



MAKERS OF FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS; RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES

Electrical Contracting, January 1946

Cutter-Hammer 9115 The Manual starter built on the premise all motors deserve equal protection

Although the Cutler-Hammer 9115 for motors that can be manually started it has the same design, construction and operation tures that have made Cutler-Hammer Ma Starters a standard wherever electric motors used. Here you will find the same "drop-of solder" eutectic alloy overload relay that distinguishes the Cutler-Hammer Magnetic Starter line . . . the same twin-break Vertical dust-safe contacts... the same pure, fine silver contact faces... the same snap action contact mechanism . . . the same simple design . . . the same dependability ... the same attractive, clean styling. Only in the absence of the electro-magnetic closing mechanism is there any difference at all. Every motor in your plant no matter how small or "unimportant" has an essential role to play in production. Every motor deserves equal care and protection. Every manually started motor deserves this degree of protection, Yet C-H 9115 costs no more than ordinary starters. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wisconsin. Associate: Canadian Cutler-Hammer, Ltd., Toronto, Ont.



OPERATING MECHANISM-Available as skeleton for building into m chines, etc. Metal parts rust-proof. Rubber mounting absorbs shocks. Mechanism removable as a unit by loosening one screw-for wiring, etc. Parts and terminals easily accessible.

COVER-"Hook-on" type. Loosen-

ing one screw permits lifting off from front. Permits close-fit installation.

CONTACT STRUCTURE-Newly designed for compactness, simplicity, strength and accessibility. Unit base construction easily removed. Positive, quick-make, quick-break, twin-break sil-

OVERLOAD RELAY-Famous C-H eutectic alloy thermal overload relay, most dependable known. Reset by push-ing top outton. Free-tripping. Rating changed by changing heater coils.

PUSH BUTTON OPERATIONachievement for this type of starter. Has start, stop-and-overload reset buttons. Start button can be locked to prevent unauthorized operation.

CASE—Modern styling and design. Standard NEMA type 1 enclosure. 8 x $4\frac{3}{4}$ x 4. Japanned steel. Interior 8 x 4³/₄ x 4. Japanned steel. Interior light finish for high visibility. Cover can

be padlocked. Knockouts top and bottom. Ample space, complete accessibility.

DETAILS-As further evidence of the DETAILS—As turther evidence of the extreme care and thought in designing this new starter, your attention is called to numerous small yet important details such as self-finding terminal screws, unique staking of cover screw, handy spring lifters on movable contacts, etc., atc.

ER-HAMMER

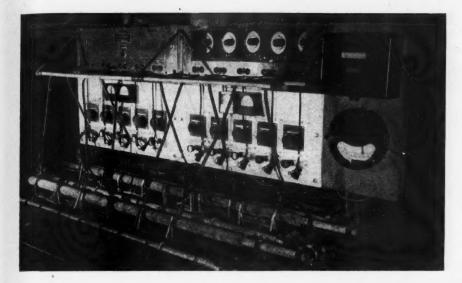


FIG. 1—Typical plating tank arrangement showing acid-resisting meter panel with rheostats, selector switches, timers and plating leads. Selector units are just below meters on white panel.

located on the panel between the meters and the controlling rheostats. The series of dials above the meters are the automatic timers. Figure 2 shows the operation of the selector switches in the meter circuits.

At first, toggle switches were employed to throw the meters in and out of the circuit. With a nominal rating of only 10 amperes, however, they were inadequate to handle the normal 70 or more amperes required for the plating process. Also, quick-action switches

SELECTOR SWITCH ELIMINATES NUMEROUS PLATING PANEL METERS

When the engineering department of the Chrysler-operated Dodge-Chicago plant designed and built silver plating tanks for the plating of B-29 engine parts, they wanted to keep the control and instrument panel as simple as possible. Also, electric meters were difficult to get at that time. One of the logical steps, therefore, was to utilize selector switches in their meter circuits. Thus, they were able to make one ammeter do the work of five.

The typical plating tank setup shown in Fig. 1 had ten extra-flexible leads to attach to the work being dipped into the solution. As indicated, two meters—one ammeter and one voltmeter—took care of five plating leads. One selector switch was installed for each work lead and

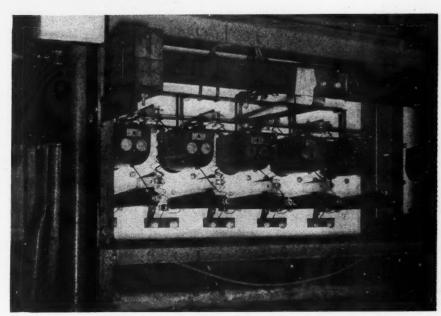
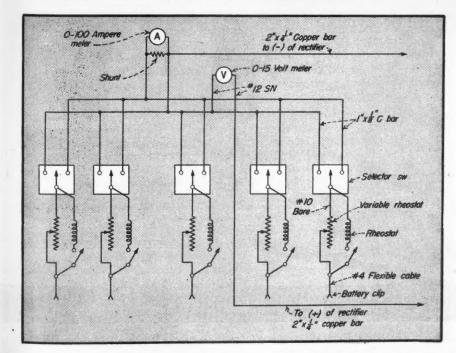


Fig. 2—Drum type selector switches are connected to meter circuit by bare copper bus. Large bus at top goes to rectifier. Rheostats are shown below the switches.

were necessary to eliminate the development of an "immersion plate" (a plat-

ing deposit without current, the adhesion of which is poor) which, if plating were continued would produce a laminated plating that would not stand up under



wear.

To secure the necessary quick-action, current capacity, and still retain the selective feature, the engineering department redesigned and substituted a conventional two-position drum switch for the toggle units. Each drum switch has

FIG. 3—A single ammeter measures the current in the five plating leads. Circuit diagram shows selector switch connections to ammeter. Second unit is a voltmeter.

Flexibility—for smooth going on the job





Killark Service Entrance reversible fittings are designed for complete watertightness when used with either horizontal or vertical conduit.



Type FB—Reversible entrance caps for 2, 3, 4, or 5 outlets with $\frac{1}{2}$ " to $\frac{1}{2}$ " herizontal or vertical conduit.



Type FB—For vertical or horizontal 2" to 4" conduit. 2, 3, or 4 outlets.



Type BF—for 3" to 5" horizontal conduit with 2, 3, or 4 outlets.



Type FKB Flanged Entrance Fit ting—For $\frac{1}{2}$ " horizontal conduited with 4 outlets. They are designe primarily for frame hulldings.



Type SLB Entrance Elbow with rub ber gasket for ½" to 3" conduit Sturdy, durable and weatherproof



Type GSLB Entrance Elbow with grounding hub—rubber gasketed for 3/4" to 11/4" conduit.

RILLARK RILLORDE Keiner Control of the Keine

Killark fittings offer flexibility to the outside as well as the inside part of the job. Keep posted on the complete Killark line—with the latest

Keep posted on the complete Killark line—with the latest complete Killark catalog.

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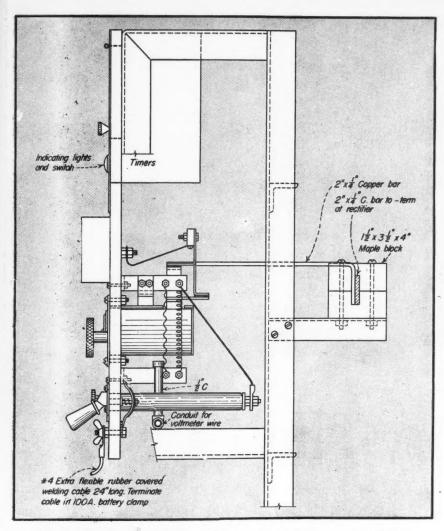


FIG. 4—Elevation of plating tank control panel showing installation of the drum selector switches, rheostats and timers.

three positions: Left—a "momentary contact" to get a quick current indication; center—a locked "off" position; right—a locked "operating" position.

The back-of-panel connections (Fig. 3) between the selector switches and the meters are made with 1-in. by \(\frac{1}{8}\)-in. bare copper bar. Bus connections to the copper oxide rectifier are made with insulated 2-in. by \(\frac{1}{4}\)-in. copper bar supported on maple blocks. The result is a compact, neat wiring installation.

The flexible leads are made from No. 4, extra-flexible, rubber covered welding cable with a 100-amp. battery clip at the work terminal and a soldering lug with a thumb-screw mounting at the panel connection. The meter panel is composed of two \(\frac{1}{4}\)-in. layers of fibre board with a \(\frac{1}{4}\)-in. white, acid-resisting facing.

Drum selector switches, rheostats and timers are neatly installed in the control panel (Fig. 4), as well as indicating lights and switches, and plating leads. Location of copper bars is also shown in Fig. 4, indicating the simple arrangement worked out by the engineering department.

WHERE AMPERES WASTE DOLLARS

_INDUSTRIAL

Every industrial contractor knows that his customers are eager to make the most of every dollar spent for power. So greater emphasis is being placed on finding the places where power waste may be checked. When found, however, there is yet the question of interpreting these findings so they are understood by management.

Regardless of the instrument used, whether it gives a graphic record or permits setting up an array of indicated readings, the contractor's job is to work out these facts in terms of dollars saved. This means that the cost to relieve overloaded feeders, over-motoring or miscellaneous leaks should be shown as justifiable, if positive action is to be expected.

In a word, industrial selling depends on case studies worked out in figures. And here is a good example that talks dollars and amperes. The values are taken from readings made with a splitcore portable ammeter and a voltmeter. Analyzing Overloaded Feeders

Assume 150 amperes transmitted 1000 ft. through a pair of No. 0 wires.

The total resistance is 0.2 ohms. Therefore, the watts lost are $150^2 \times 0.2$ or 4,500 watts. Yearly cost is 2400 hours $\times 4.5 \text{ kx} \times \0.01 or \$108.00. Moreover, the voltage drop is 150×0.2 or 30 volts, say from 240 at the source to 210 at the load, at which voltage motor speed regulation is not very good and motor efficiency is lowered.

Besides, these feeders are running rather warm, and the thought arises that they might profitably be paralleled with a duplicate set or replaced with a pair of No. 0000's.

The No. 0000's would have a total resistance of 0.1 ohm, and their losses would be $150^{\circ} \times 0.1$ or 2,250 watts. These losses would cost $2400 \times 2.25 \times \0.01 or \$54.00 per year. Their voltage drop would be only 150×0.1 or 15 volts, say from 240 volts to 225 volts. The dollar and cents saving per year would be \$108.00 minus \$54.00 or \$54.00, which might or might not justify installing the additional copper. However, there may be other considerations such as—

(a) the circuit is 3-phase, and there are 3 conductors instead of two. The saving then becomes $$54.00 \times 3/2$ or \$81.00.

(b) the plant may be running 3 shifts, which is 7200 hours per year instead of 2400 hours. The saving then becomes 3 × 81.00 or \$243.00 per year.

(c) the power cost might be \$0.015 instead of \$0.01 per kw. hour, in which case the savings become $$243.00 \times 1.5$ or \$365.00 per year.

Putting up 2000 pounds of copper will save 2,250 watts. Assuming that the installed job cost is \$1,000 and has fixed charges of 10%, or \$100.00 a year, we have—under condition

(1) Loss of \$19.00 per year.

(2) Net profit of \$143.00 per year.

(3) Net profit of \$265.00 per year. Even under conditions (b) or (c) it may or may not be decided to go ahead and make the saving, but the point is

(1) The losses, in dollars and cents, are known.

(2) The possible savings in dollars and cents, are known

(3) The decision can be made from arithmetical facts.

Incidentally, the salesman who introduces this sort of figuring is in a good position to get any resulting material purchases.

Interpreting Miscellaneous Losses

For checking up miscellaneous losses, two indications are necessary

(1) Periodic readings — preferably monthly — on the more important feeders and drives.



Results from plant lighting—as it affects quality and quantity of work-depend on the flexibility and dependability of the system from which it taps its current.

Here is where BullDog's nearly 50 years' leadership in the electrical distribution field really counts. Universal Trol-E-Duct-pioneered by BullDog and proved by industry—is the best way to provide continuous electrical outlets for any type of lighting, wherever and whenever needed.

Standardized and pre-fabricated in all its parts, it is completely adaptable-no re-wiring when machines are moved or entire plant layouts revised. It's 100% salvable, too; the whole system can be dismantled easily and without loss for re-installation elsewhere.

Why get along with old-style FIXED electrical outlets in your plant? Investigate Universal Trol-E-Duct-adaptable to fluorescent, mercury vapor or incandescent lighting. Consult BullDog field engineers or write us direct.

BUY VICTORY BONDS

SALVAGE PAPER

DETROIT 32, MICHIGAN In Canada: BullDog Electric Products of Canada, Ltd., Toronto. Field Offices in All Principal Cities.





Also Manufacturers of Vacu-Break Safety Switches — SafToFuse Panelboards—Switchboards—Circuit Mas-"plug-in" power — Industrial Trol-E-Duct for movable "loads." (2) Indicating readings to show the effect of changes or corrections while they are being made.

To get these into dollars and cents we have to consider what an ampere costs. Assuming 300 eight hour shifts per year and current at one cent per kw. hour, a 3-phase 220 volt ampere at 85% power factor costs—

$$\frac{1 \times 220 \times 1.73 \times .85 \times 2400 \times \$0.01}{1000}$$

= \$7.76 per year.

If the voltage is 440, the ampere then costs \$15.52 a year; and if in addition the plant runs three shifts a day, the ampere then costs \$46.56 a year, for each cent per kw.-hr.

On one occasion, a pump was changed on the basis of similar figures. This change cost \$900.00 to make and saved over \$300.00 a month. The old pump had been running ten years and had wasted \$36,000 worth of current. There is real money to be saved on such checkups.

Ordinary losses are scattered leaks, such as—

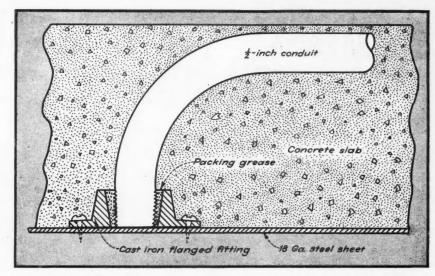
- (1) Overtight belts. Slacking a belt will reduce losses up to 5% before it begins to slip.
- (2) Lubrication check-ups. It takes watts to heat a bearing, just as it does to heat a toaster.
- (3) Misalignment of line shaft bearings. A very common condition, that is costly even if slight. To correct misalignment slack the adjustment screws, let the shaft align itself, set hand tight, and lock, observing meter reading meanwhile.
- (4) Bottoming or misaligned gears. Unduly noisy gears are power eaters. Realign, watching meter while so doing.
- (5) Improperly ground tools, particularly drills and reamers. Insufficient clearance on metal cutting tools is quite common, and may be an important loss.

There are many more of these miscellaneous leaks, and in addition frequently there will be glaring losses that have grown up slowly and have not been noticed. Pumps and compressors are the most common sources, due to worn parts and shifted adjustments.

These are disclosed by the periodic measurements, taken each month. If the readings increase month after month, attention is called to the trouble.

The smart industrial contractor will rely on electrical instruments to get these facts. Then these findings must be interpreted in terms of dollar savings. Business will follow.

Contractors working on low cost fireproof housing construction face a tough problem in setting conduit in place be-



Flanged fitting aids conduit installation in concrete forms for Bross Electric Co., Hartford, Conn.

fore concrete is poured. Heavy steel sheets are used by most contractors as a form on which the concrete is poured to form the slabs. Conduit must be put in place and the concrete mix then poured over the pipes and on to the forms.

It is impractical to drill holes in the steel sheets to permit the conduit ends to extend through and be exposed on the concrete slab when the forms are removed. If the conduit is threaded on the end, and merely braced in place above the steel sheet, when the concrete is poured it embeds the threaded conduit end tight in the concrete. This makes it almost impossible to remove the concrete from around the threaded end without damaging the threads when the forms are removed.

A practical solution to this problem has been worked out by T. B. Bross, electrical contractor, Hartford, Conn. It is simple, makes a neat job, and is inexpensive. It consists of using a flanged fitting with a tapered hole through the center of the hub. Made of cast iron, these fittings are fastened in place on the steel sheets with tapered screws. The threaded end of the conduit is then placed in this hub, and the tapered space within the hub is filled with ordinary axle grease.

When the steel forms are removed after the concrete has set, these fittings come down with the forms. This leaves a space around the hub end of the conduit which will permit the use of a coupling without having to remove any concrete. The grease can be cleaned from the conduit, leaving clean, well protected threads to facilitate and speed up the completion of the wiring job. Details of this fitting are shown in the accompanying sketch. Separate size fittings can be made for each size of conduit.

HYDRAULIC PRESS MADE FROM TRUCK JACK

_INDUSTRIAL

Having need for an hydraulic press for light work, the Roller Industrial Electric Co., Los Angeles, Norman Roller shop superintendent, supplied the need by utilizing for the hydraulic element an automotive truck jack, converted so as to operate in an inverted position, see photograph. Rated at a capacity of 5 tons, they have been able to operate it on overloads up to 10 tons.

The welded frame was constructed in their own shop out of 6-in. channel iron. The jack was converted by taking it apart and reversing the oil intake line so that oil reaches the master cylinder to operate the ram. This was done by inserting a small pipe and oil intake in the head of the jack so that, when the latter is inverted, the small pipe will reach the pool of oil.



Hydraulic press for light work is made from auto truck jack.



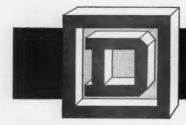
You can change magnet coils, contacts or overload relays in no time at all—and without disturbing external connections. Square D is designed for simplicity.

You have plenty of wiring space and easy-to-get-at terminals. Installation and inspection is faster and easier. Square D is designed for accessibility.

You can be sure that any starter from Square D's unusually complete line will deliver the kind of service which builds customer confidence and good will. Their performance in thousands of plants proves that Square D starters are built to "take it."

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Square D Company, Industrial Controller Division,

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Staging Installation In Trusses

(Work platforms for conduit job)

BUILDING CONSTRUCTION:

Industrial building; steel trusses 18 ft. above floor level; wood roof on heavy wood members which rest on steel; steel trusses 20 ft. on center; supporting steel columns occur under trusses at 35-ft. intervals forming 20-ft. by 35-ft. bays; roof timbers vary from 4'-6" to 7'-0" above bottom of trusses.

NATURE OF JOB:

Conduit is to be installed on roof timbers and is to parallel the trusses. Job involves installing three 20-in. by 24-ft. stages between trusses; also to install a catwalk of two 28-in. by 24-ft. units to rest on the cross stages on the trusses. Catwalk to parallel trusses directly under line of conduit run.

JOB CONDITIONS

Building is large and initial setup required moving the stages from the loading platform. Floor is heavily congested, but does not materially affect the installation. It is necessary to raise one end of the 20-in. stage up, slip it over the truss, then raise the other end and slide the stage back so it overhangs two feet on each truss. After the three supporting stages are resting on trusses, the 28-in, wide catwalks are placed on the stages parallel to the trusses.

To move to the next bay, after the conduit installation is completed, the 20-in. supporting stages must be lowered, moved and raised to the new position as previously described. The 28-in. catwalks can be slid over without lowering, being raised and held in place with ropes and pulleys. After the supporting stages bridging the trusses have been positioned, the catwalks are pulled over with another rope and pulley while the tension of the supporting ropes is being eased off to permit the catwalk to be pulled over in a semi-horizontal direction to rest again on the supporting (20-in.) stages.

LABOR ANALYSIS

The original setup requires considerably more time than the succeeding operations. Labor data, therefore, should include an initial setup item regardless of the size of the job; also an item for final disassembly (takedown) and removal. If the job is small and doesn't require planning, etc., the initial setup will not require making up of grappling hooks, snatch blocks, etc., and should take only 1.2 man-hours instead of the 1.75 man-hour unit in the accompanying table (See small job unit in table designated thus*).

The smaller job described above would normally employ only two men for the stage erection, while on the larger job where more men are working on the stages, their work would be completely interrupted if they did not assist in the stage shifts. The time on larger jobs will lag behind that of the smaller jobs. This is reflected in the units presented in the table.

The installation under discussion is the type where the conduit work can be done by the men standing on the stages and reaching the roof members. If this isn't possible, the value of this type of stage setup is considerably depreciated since additional ladders would have to be used on the stages. It is not uncommon for the roof to be at a convenient working height above truss bottoms where steel trusses are encountered. This should always be carefully checked on each job. If the floor areas were clear, rolling scaffolds could be used to advantage.

Where work must be installed above operating equipment and employees, it is frequently necessary to do this phase of the installation after hours on overtime. This often in-

LABOR DATA					
No. of Stages	Size of Stages	Type of Work involved	Men-Hours		
			Unit	Total	
5	24-ft. long	Original Setup Large Job — initial bay — requires planning, making grappling hooks, preparing snatch blocks, initial moving to location and setup for first 20-ft,			
		bay. Small Job — initial setup — requires no extensive planning, preparation	1.75	6.00	
5	24-ft. long	of grappling hooks, snatch blocks, etc. Moving Between Bays Normal Move — lower the 20" sup- porting stages and raise to position in next bay, slide 28" catwalks over trusses onto newly positioned stages. Skip-Move — When necessary to re-	0.50	2.50	
5	94-ft.	trace steps back several bays to do work originally "skipped" because unusual congestion or employee operations at the time. Requires complete takedown and setup. Final Disassembly	2.40†	12.00	
,	long	Large or Small Jobs — includes taking down stages and removal to loading platform.	0.75	3.75	

Note: For labor units designated (*) and (†), see discussion under Labor Analysis for explanation.

volves a certain amount of "skip-moving" to bypass these sections. When this is done scaffolds have to be moved back several times to complete these "skipped" areas. This requires a complete takedown and setup of the stages since it is obvious that they can't be slid back over several bays with any degree of efficiency or economy. The labor for this would involve 1.2 man-hours for takedown and 1.2 man-hours for setup for each stage used. To move back to a point of interrupted work sequence then would require 2.4 man-hours per stage (note "skip-moving" unit in table marked thus †) instead of the 0.5 man-hours for normal moving.

LABOR CLASSIFICATION:

One "A" man; balance of labor, "B" men. This type of work requires one capable mechanic supervising and average assisting mechanics.

The types of available labor are rated A-B-C-D-E, with the units based upon average use of B labor. In general, an A man will run the job assisted by B and C labor, which will average class B. In abnormal times the general labor classification will fall to D and E for new labor being employed to fortify the regular personnel. It must be noted that the classification applies only to rate of time and not to knowledge or mechanical ability. A splendid mechanic may be rated C from a rate of time classification.

be rated G from a rate	e of time classification.		
Labor Classification	Changes in Standard Units		
A	deduct 10%		
В	no change		
С	add 10%		
D	add 20%		
E .	add 30°/		

The labor classification shown in the estimating data above shows the labor classification rating of the mechanics who performed the particular job so that adjustment can be made on the type of labor available.

Data from L. W. Witz, Continental Electrical Construction Co., Chicago, III.



Westinghouse says: "Permanent high reflection surface is insured by Alzak Process finish on reflectors and biflectors"

Reflectors, made from Alcoa Aluminum sheet, are given a mat surface for diffuse lighting, or are polished to a highly specular surface for accurate light control. An Alzak finish assures permanently high reflection factors.

With Alzak-finished aluminum reflectors, there's no chipping, because the smooth, glasslike, hard oxide coating is an integral part of the metal. They are easy to keep clean and working at high efficiencies.

Alcoa does not make reflectors, but supplies top quality aluminum sheet to reflector manufacturers. Be certain your supplier understands how reflectors are to be used, so he can give you the correct finish for each job. Aluminum Company of America, 1946 Gulf Building, Pittsburgh 19, Pennsylvania.

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ENGINEERING . INSTALLATION . MAINTENANCE

High Frequency Heating—II

Selectivity and accuracy of control features the advantageous application of high frequency induction heating to industrial heat treating problems. Many of these are outlined in this article.

THE use of high frequency energy for the heating of metals has been standard practice in many manufacturing plants for the past several years, resulting in tremendous economies and permitting the processing of parts with qualities and at production rates not obtainable in any other way. Although used for many years in the making of steel and for various heating for forging applications, it was not until the development of the process for surface hardening

By Dr. H. B. Osborn, Jr.

Director of Research, TOCCO Division
The Ohio Crankshaft Company
Cleveland, Ohio

crankshaft bearings and further development for other parts that the method was given the consideration it so justly deserved.

Over 500,000 kilowatts of induction heating equipment are in operation today in countries all over the world despite the fact that the equipment was not actually perfected until less than ten years ago. However, it had been demonstrated some forty years before that metals could be heated when placed within the confines of a loop or a conductor carrying alternating current. Today this selective heating method is treating a multiplicity of parts and although considered to be widely used, induction heating is still in its infancy. Its ultimate utilization for the heat treat-

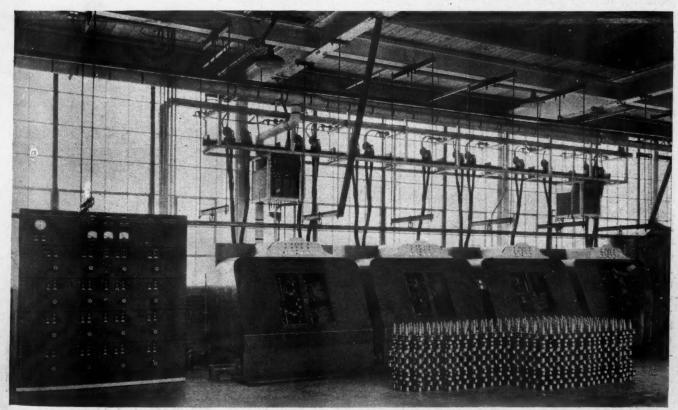


FIG. 1—Bank of induction heating units for hardening medium sized diesel engine crankshafts. Each unit automatically processes 3 or 4 bearings in succession. Production, with one operation, is twenty-five 14-bearing crankshafts per hour.

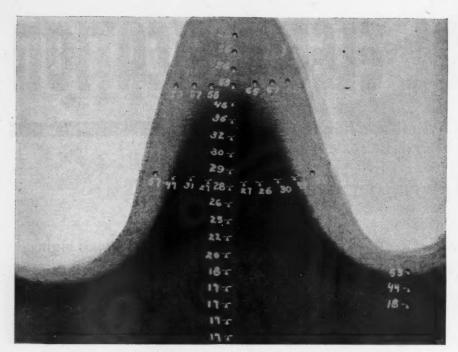


FIG. 2—Contour hardening of a 36-in. diameter, 5-in. face gear with 9600 cycle induction equipment is shown by this tooth section. Result: high wear resistant surface, tough ductile core. Numbers are Rockwell "C" readings.

ing and surface hardening of metals, heating for forging and forming, and brazing or soldering of similar or dissimilar metals challenges the imagination. Induction heating makes possible the production of steel parts hardened in specific locations with the desired magnitude and depth of hardness, essential metallurgical structure of core, demarcation zone, and surface with a practical lack of distortion and no scale formation. It is readily adaptable to through-heating of heavy sections for hardening or forming or brazing operations covering complete temperature ranges including those necessary for melting-a phase of induction heating not discussed here.

It is readily admitted that the war has had a tremendous, stimulating effect on the wider acceptance of induction heating. But on the other hand, had it not been for this process we would have been unable to manufacture many of the articles of warfare so important to victory. As a specific example, note that a majority of our trench mortars, chemical and smoke shells were designed to take advantage of high frequency heating for brazing the shell assemblies, permitting simple design and facilitating output.

CORRECTION

Formula for depth of penetration given in the first article in this series (December, Page 143) should be corrected to read

$$D = \sqrt{\frac{4}{F}}$$

Many complicated forgings or castings have been replaced by brazed assemblies comprising simple sub-units either forged, cast, or stamped. Such parts include rocker arms, shafts with bushings, distributor cams, and other parts too numerous to mention.

Forging operations associated with induction heating permit closer control, higher production, and better utilization of press or hammer and man hours.

Surface hardening makes it possible to eliminate expensive pretreatments such as copper plating and carburizing and costly subsequent straightening and cleaning operations; to cut down on material costs by having a wider selection of steels from which to choose; to fully harden machined items without the necessity of any finishing operation; and to process articles of intricate design which cannot feasibly be treated in any other way.

Complete details on many of these applications will be discussed later.

Perhaps the greatest single advantage usually associated with the adoption of induction heating for producing wear resistant surfaces is the feasibility of changing from alloy to carbon grade of steels. Crankshafts formerly heat treated to approximately 300 Brinell—representing a compromise between wear resistance and machinability—were made of alloy steels, but not because of the higher core properties attained. Substitution of plain carbon steel results in tremendous

economies which, with sufficient production, can provide adequate saving to pay for the cost of the induction heating equipment within as little as six months time (Fig. 1).

Gears of high alloy steel, manufactured at great expense due to high machining and material cost and scrap losses, are now made from such steels as SAE X1335 or SAE 1045. They may be completely machined, including shaving, in a soft annealed or normalized condition and then induction hardened without distortion to hardness specifications dictated by usage. Within the limitations imposed by fineness of pitch, frequency and size, surface hardness is obtained for high wear resistance leaving a tough ductile core (Fig. 2). In some instances higher core properties than are obtainable from the above steels may be necessary, in which case alloy steels are used although the need for same is questionable. Such parts, as well as those made from carbon steels, are hardened and drawn to necessary core properties and after complete machining the teeth are induction hardened. In this manner hardnesses well above those of ready machinability can be used compared to those of conventional methods wherein machining is done after heat treating.

In the manufacture of internal combustion engines and auxiliary motivating equipment, induction heating is finding very extensive use. The war has benefited considerably by the high production rates inherent in the use of such equipment although the automotive industry had adopted this process for many of their parts prior to the war. The appli-

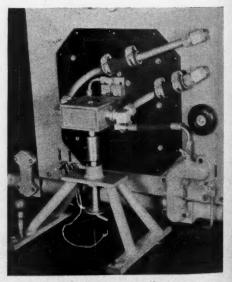
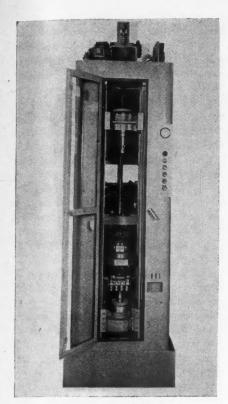


FIG. 3—Single-shot setup for hardening the spherical surface on a ball stud with induction heating equipment.

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FIG. 4 — Movable inductor in this automatic setup scans the surface of long cylindrical stock to be progressively hardened. Unit is adjustable for various lengths and for controlling length of hardened area. Heating is followed by a quench for hardening.

cations so naturally associated with this method of surface hardening are of such a wide variety that it would be impossible to do justice to each and every one. A few of extreme importance, however, are bearing races, axle shafts, cams, gears, eccentrics, and bearings on camshafts, bearings on crankshafts, tips of rocker arms, wearing areas on rocker arm shafts, piston pins, king pins, pump shafts, gears, valves, and others.

The technique used for surface hardening depends upon the hardness requirements, particularly with reference to the dimensions of the part and hardened areas. For example, for processing of a shaft of considerable length where only a small bearing area is to be hardened, a simple inductor block and locating mechanism for "single shot" processing is used (Fig. 3). Where the area is rather long, the inductor scans the surface and we use a progressive method of heating and quenching. This, for example, is used for surface hardening of track pins, piston pins, king pins, pump rods and roller bearing races (Fig. 4).

The type of mechanism used for locating depends upon the size of the part and the production requirements. An automotive valve being very small and re-

quiring hardening of the tip can be processed in a simple fixture for heating one or two tips at a time and can be loaded manually (Fig. 5). For higher production, a multiple hole inductor block would be used, necessitating speedy handling on the part of an operator. For still higher production, the valves or similar parts are hopper fed into a conveyor mechanism which passes the tip continuously through a "hairpin" type inductor coil giving production rates of several thousand parts per hour with a minimum of labor charge (Fig. 6). For certain applications, hopper feeders are used.

HEAT TREATING

One of the greatest contributions of the induction heating process to the war effort has been its ability to produce an armor piercing projectile with superior penetrating qualities. Although precise methods of treatment may not be disclosed, it may be revealed that shot in sizes of from 20 mm. to 8-in. diameter are standard production items not only in this country but in Canada, England, and other Allied Nations.

With the restricted use of copper it was necessary to give some consideration to the manufacture of steel cartridge cases. Although the physical properties necessary to insure the return to the original shape after firing are introduced.

into the cases by cold working during the drawing operation, these have in many cases been inadequate. Induction heating was used to supplement these physicals by progressively heating and quenching of the section of the case subject to failure. Such processing is standard on all 3-in. Naval cases (Fig. 7).

Further development of the technique so successfully used for surface hardening of cylindrical stock has resulted in a process for continuous through-heat treatment of materials. Bars or tubes are passed through an inductor assembly having a specific power input and at a controlled rate so that it is heated uniformly throughout its entire cross section to hardening temperatures. Its forward motion carries it into a quench chamber from which it emerges in a fully hardened condition. Elimination of the quench makes possible annealing or normalizing, whereas continuing of the stock through the machine can cause it to pass through another inductor which, by control of power input, will re-heat material to any pre-selected drawing temperature and thence to a quench manifold to cool for handling. The end product is clean, straight, and with a perfectly uniform sorbitic grain structure throughout its entire cross section from one end of a bar to the other, and from one bar to the next. Standard equipment

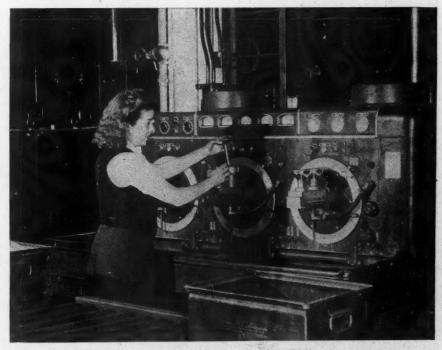


FIG. 5—Three station induction heating unit for production hardening of aircraft engine valve tips. Each station processes two parts simultaneously. One station heats while other quenches and third is being unloaded and loaded. One operator can handle 2400 small valves per hour.

handles stock up to 2½-inches in diameter (Fig. 8).

BRAZING AND SOLDERING

Almost without exception, all chemical shells, smoke shells, incendiary bombs, and trench mortars were assembled in part or completely with induction equipment (Fig. 9). Burster tubes, base plugs, nose adapters, etc., were made mechanically strong and pressure tight by the use of various brazing alloys, generally limited to silver solder. A few incendiary bombs used copper brazing alloys.

Brazing of carbide or high speed tips

to cutting tools has added tremendously in speed of production and saving of critical materials (Fig. 10). Of further importance is the salvaging of tips or shanks when broken in use, to say nothing of being able to braze standard high speed tools to long mild steel shanks or repair damaged tools. Although many of the brazing applications are completed in a single or multiple hold inductor, some are being processed in a continuous manner. For example, the electrodes are silver soldered into spark plugs as they pass continually through an inductor loop on an automatic conveyor as are various shell assemblies, tube adapters, distributor cams, and similar parts.

For the hundreds of assemblies which require brazing, the use of induction equipment, regardless of the type of solder needed (lead, silver, brass, copper, or special alloys), results in a product free from distortion and effect of heat in areas adjacent to the brazed joint, and with a uniformity of product, economy and speed of production not equaled by conventional methods.

HEATING FOR FORGING

The many advantages inherent with the use of induction heating for forming and forging operations have been responsible for its wide acceptance and use. The greater proportion of large caliber shells produced for the war were heated with high frequency energy. Temperatures ranged from some 1600° F. to 2400° F. depending upon the amount of metal to be heated and the method of forming which would include pressing, toggling, swaging, and spinning. If a sufficient amount of equipment could have been made available, more shell manufacturers would have used induction heating. Fortunately, however, most of these facilities were able to obtain equipment and its use has aided tremendously in the war effort. As a matter of fact, many manufacturers refused to accept shell contracts without the proviso that they be permitted to install high frequency units for the heating operation.

High production rates, low operating cost, reproducibility of a uniform temperature or a graded temperature, lack of scale, and accompanying increase in die or tool life are advantages which may be difficult to evaluate in terms of dollars and cents, but weigh heavily in favor of the induction process when comparisons are made to furnace methods, and are sufficiently inportant to justify a high operating cost for energy and installation charge.

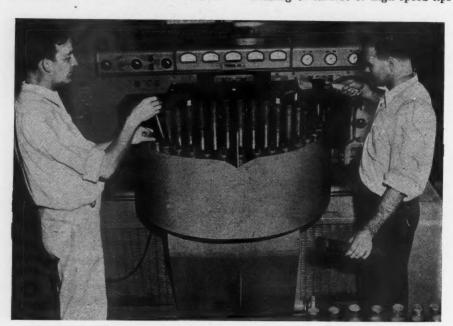


FIG. 6—Annealing flanges of 40 mm. cartridge cases by passing them, while rotating, through an inductor loop. Production: 1200 per hour per operator.

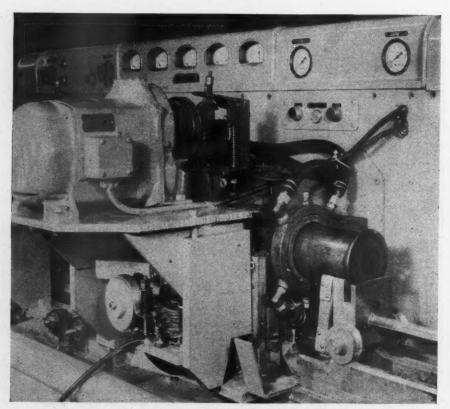
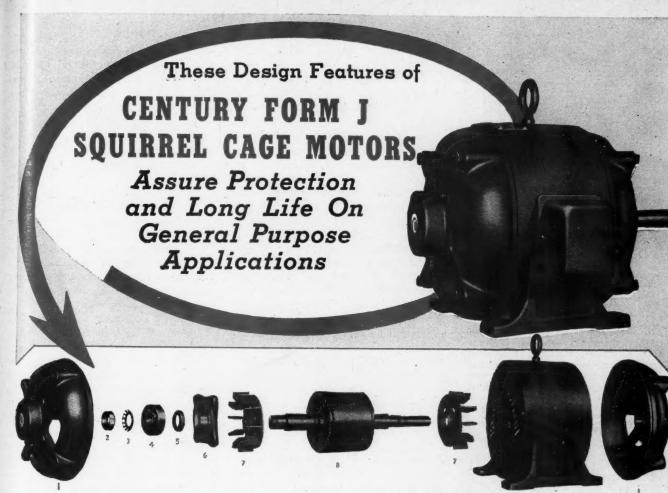


FIG. 7—Continuous heat treating of side wall of 3-in. shell cases. Automatic mechanism pulls through high frequency inductor and quench assembly.



1. Bearing Brackets are ruggedly built to maintain bearing alignment; top half is closed to prevent falling objects and dripping liquids from entering the vital parts of the motor. Cooling air enters through openings in the bottom half of the bracket.

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- 2. Bearing Nuts and outer Grease Seals lock the inner ball bearing race on the shaft and fit over a machined concentric extension on the inside of the bearing housing in the end bracket forming a grease sealed enclosure keeps dust out, grease in.
- 3. Lock Washers hold the bearing nuts tight.
- 4. Ball Bearings are grease lubricated, self contained, single row open ball bearings. Bearings may be removed and cleaned or replaced and positively locked in place when reassembled.
- 5. Grease Seals extend over a machined concentric extension on the inside of the bearing plate, forming a grease seal for the inside end of the bearings.
- 6. Bearing Plates hold the outer bearing race in place and close the inside of the bearing housings.

- 7. Ventilating Fans, one on each end of the rotor, and scientific arrangement of air passages remove heat and reduce danger of hot spots assure long insulation life.
- 8. Welded Copper Squirrel Cage Rotor provides positive uniform cross section of conductors which gives uniform operating characteristics and long life.
- 9. Cast Iron Frame is rigidly reinforced with inner ribs; ventilating passages are large and smooth. Stator core provides a high degree of resistance to industrial atmospheres and moisture in damp areas. This is a result of Century's Triple Insulation—
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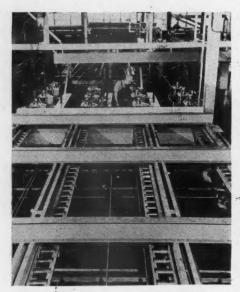


FIG. 8—Progressive heat treatment of bar stock by induction heating. Bars pass continuously through unit for heating, quenching and drawing. One operator can handle 1,000 lbs. of stock per hour with the four-unit setup shown here.

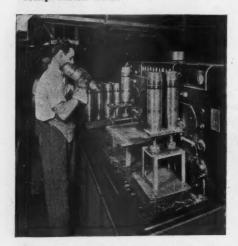


FIG. 9—Silver brazing adapters in the nose of high explosive shells with induction heating equipment.

The forming of nose and tail ends of 100, 250, and 500 lb. aerial bombs was completed quickly and easily after heating to 2400° F. Furnace heating periods of five to six minutes can be reduced to 60 seconds with induction heating (Fig. 11).

Propeller hubs, both of steel and aluminum, are heated for upsetting of the flange, and gun tubes such as the 40 and 75 mm. for upsetting of the breech or muzzle roller lugs.

When the heating operation is performed on the end of a part, induction heating makes it possible to minimize transfer of heat by conduction and produce the sharp heating pattern necessary for accurate forming operations. Upsetting off the end of a bar can therefore be accomplished with a minimum of stock

loss on multiple lengths. Where forming operations require the use of a completely heated billet or slug, manually loaded or automatic mechanisms are available for heating to necessary temperatures. Thus, for example, a single slug may be placed manually in an inductor and similarly unloaded after being heated; or the slug may be automatically inserted in the inductor and similarly ejected at the end of the proper heating cycle. In general, for high production work, slugs are passed continuously through the inductor coil which may be horizontal or vertical. In this manner, the material is brought up to temperature gradually and uniformly throughout its entire cross section. Small slugs may be passed through inductor coils lined with quartz tubing. Heavier slugs, on the other hand, are supported on watercooled guides. Vertical heating coils serve for medium and heavy weights wherein the guides need only position the slug without supporting the entire weight as the parts are moved upwards.

Unusual Applications

In all cases, induction heating is used for purposes of increasing the temperature of conducting materials. The temperature reached is determined by the result required which generally is one of producing metallurgical transformations, removing stresses, causing brazing alloys to flow, or producing a condition which will permit hot forming. In a few cases, however, a single heating operation is sufficient to produce several of the above conditions simultaneously, or bring about dimensional changes for reasons which will be mentioned.

Previous methods of manufacture of the balancer shaft for a diesel engine required either that the shaft be machined from large diameter stock or a portion of it be upset to provide for a flange in the center of the shaft. In either case the operation was rather expensive and in addition required heat treating methods for producing wear resistance on the thrust face of the collar as well as the adjacent bearing. This shaft is now made by machining from cylindrical stock of sufficient diameter to permit threading and minor step downs, after which a collar is placed on the shaft to act as the flange. The face of the collar is hardened for wear resistance, silver brazed to the shaft, and the adjacent bearing hardened by processing in an inductor block on a standard high frequency unit, all in a single operation.

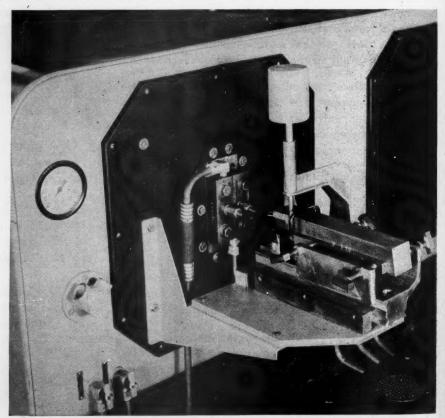


FIG. 10—Carbide tips are brazed on cutting tools with this standard fixture for induction heating equipment. Simple design of inductor loop and adjustable fixture handles complete range of tool sizes and shapes.

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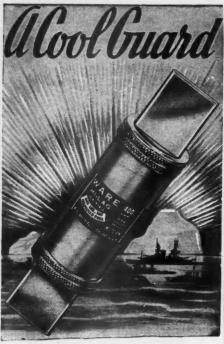
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Fly wheel ring gears are assembled by quickly heating the ring gear for expansion and, after pressing on the fly wheel, immediately quenched to shrink fit the gear in place.

Earlier methods of manufacturing double flanged track rollers for tractor tread assemblies required the welding of two rollers to a hub following which the roller surfaces were hardened. Now this operation is completed by mounting the two rollers in position in an induction heating machine adjacent to the track roller hub and heating until the surface of the track roller is brought up to hardening temperature. The operation is controlled in such a way that the amount of heat which drifts to the bore of the track roller is sufficient to cause expansion following which the rollers are pressed on the hub. Subsequent to this, the surface of the track roller is quenched to produce surface hardening of the roller face and adjacent flanges and to shrink fit the roller to the hub. The assembly thus produced will withstand testing pressures of 90,000 pounds which is 500 percent stronger than the assemblies previously made by welding.

Selection of Equipment

• With approximately 15 manufacturers advertising induction heating equipment, the selection of a particular make or type is a problem which must be faced by those organizations and individuals purchasing such equipment. There are certain factors which must not be overlooked. Based on the practical aspects of the situation, one can arrive at fairly definite conclusions as to the type of

Fly wheel ring gears are assembled equipment most suited by referring to the quickly heating the ring gear for exfollowing factual data:

Heating of relatively small diameters cannot be successfully accomplished with motor-generator frequencies. Surface hardening of 4-in. diameter material is best accomplished with frequencies above 200,000 cycles. It would be rather difficult to make any definite statements relative to surface hardening smaller diameters, but it is not felt that one could successfully surface harden 1-in. diameter material or less, regardless of the frequency employed. Surface hardening of thin wall stock is in general limited to a minimum depth of 0.100-in. except in a very few cases where with ultra high frequency equipment, but with limited power output, enough energy could be made available to process small diam-

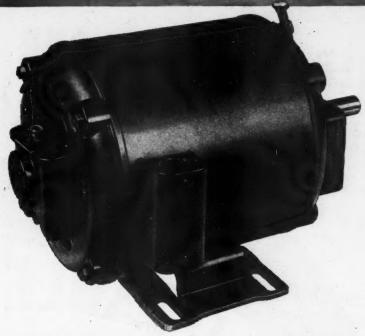
Through-heating of material of say 4-in. diameter could be completed successfully with 10,000 cycles to hardening temperature, but the efficiency of heating would be so poor at 2000° F. that frequencies of above 200,000 cycles and preferably above 400,000 cycles would be recommended.

Through-heating of sections several inches in diameter is only practical with motor-generator frequencies, particularly if temperatures are high—as for those used in forging. The use of frequencies of several hundred thousand cycles produces a concentration of energy on the surface such that, regardless of how low the energy input per unit of surface area might be, heat flow by conduction would not be sufficient to overcome radiation losses or a tendency to overheat the surface.



FIG. 11—Nose and tail of 250-lb. aerial bombs being heated in this 200-kes., 300-cycle, two-position induction heating unit. Heating time is 55 seconds.

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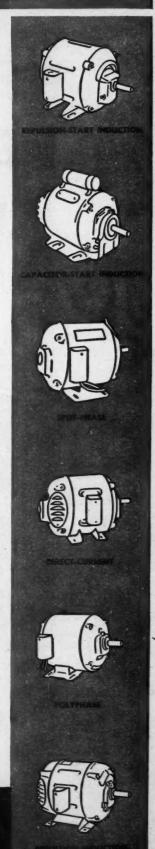
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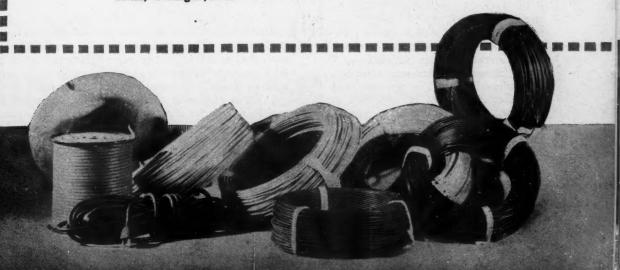
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READER'S QUIZ

OVERLOAD RELAYS

UESTION 200—We have a group of ½ hp. squirrel cage induction motors, 220 volts, 60 cycles, 3 phase. They drive separate conveyors. The conveyors cannot be stopped when they are reversed. We have a motor operated timer that controls each of the motor reversing starters. These motors operate from forward to reverse; in other words, we plug these motors.

I would like to know if it is possible to protect these motors with the proper size overload relays. We depend on fuses.—R.E.P.

TO QUESTION 200—Fuses used in the conveyor motor lines will not protect the motors because their carrying capacity must be such that they will carry more than locked rotor motor current and would not blow if the motor was carrying a heavy sustained overload.

A thermal overload switch or a thermal overload device with reset can be purchased to carry two heater coils.

I would install one of these in the line and select heater coils for the motor nameplate full load current.

The current value at the time the motor reversal switch is operated will no doubt be at least 75 percent greater than locked rotor current.

The success or failure of this will depend on how often reversals take place. I think you will have no trouble if the reversals are not too often. In any case, I would try the thermal elements out on only one motor to start.

If the heater coils chosen for full load current are not satisfactory, I would choose coils for not more than two values higher. You no doubt will find that it will not be necessary to increase the heater coils to greater capacities and I would not do so without approval from the motor manufacturer.

If you have been operating the motors for any length of time without burnouts,

it proves that the motors can take it.

—B.A.S.

TO QUESTION 200—It is possible to protect these motors with the proper size overload relays by using a reversing magnetic contactor and connecting overload relays in each of the outside wires. (One in each wire of one phase in series with the motor.) These same relays are used for forward and reverse.

Fuses should also be installed ahead of the contactor to protect against grounds and short circuiting.

Switches of this type can be purchased with self-contained overload relays.

We have several installations of this type in our plant and they give dependable motor protection and are operating very satisfactorily.—R.D.R.

TO QUESTION 200—When necessary to use plug, jog or inch controls for motors it is possible to protect the motor properly by using overload relays with inductive shunts placed in parallel with the heater unit to limit the current through the heater unit during the plugging period. Properly sized heaters must be selected with consideration of the inductive shunt in parallel with it to properly protect the motor and the combination is best supplied by one of the manufacturers of control equipment.—A.L.P.

D-C SOLENOID

UESTION 201—We have an installation which involves a large d-c solenoid (1000 watts at 110 volts d-c) which is used to trip a latch under certain current characteristics. There is a normally closed pushbutton station in this circuit which is there for the purpose of manually de-energizing the solenoid at certain pre-determined times.

However, when this pushbutton is actuated, the operator receives

a severe shock. We have checked the insulation of the wires and all the apparatus and find it is okay and that the equipment is correctly rated for the voltage.

Can someone tell us what may be causing this trouble and what the remedy might be?—G.S.E.

TO QUESTION 201-The operator referred to in G.S.E.'s question was indeed fortunate that he was not seriously hurt during the act of opening the solenoid pushbutton switch. Large d-c solenoids may produce inductive voltages of several thousand volts during the de-energizing period and the energy stored in the surrounding magnetic field may be sufficient to cause heavy currents of long enough duration to be dangerous. The cause of the inductive voltage is as follows: whenever the solenoid is energized, a magnetic field is produced in the iron of the core and to a slight extent in immediately surrounding structure or air. Then, as the electric circuit is broken, the magnetic field collapses causing the lines of magnetic force to cut across the conductors in the coil. The passing of the magnetic field across the conductors induces voltages in the coil in precisely the same manner as voltage is induced in the secondary of a transformer. This is known as an "inductive kick" and its occurrence is a characteristic of any coil during changing magnetic fields.

The remedy for danger to the operator is relatively simple. Several methods may be recommended but the simplest perhaps is the replacement of the pushbutton switch with a field discharge switch. Such a switch, available at most electrical equipment jobbers, is merely a modified knife switch. It incorporates a movable element which connects the terminals of the solenoid coil across a resistance at the instant the electric circuit is broken. The energy stored in the magnetic field is then harmlessly dissipated as heat in the resistance.

A second method is that of connecting an element of Thyrite lightning arrester across the solenoid terminals. The Thyrite offers high resistance to oper-

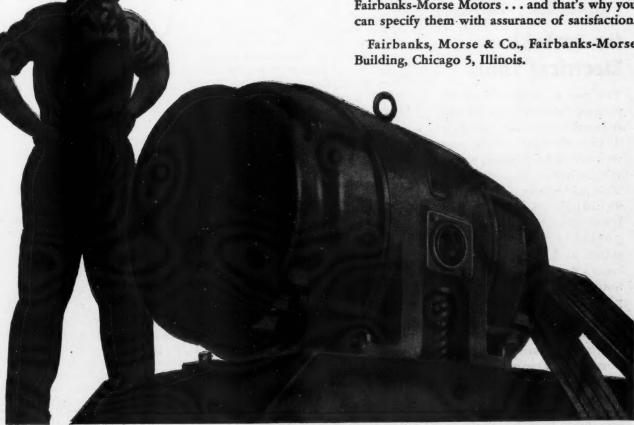
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for Portable Electrical Tools

The use of fusible Triploc plugs on extension circuits will automatically isolate a defective tool or device without interrupting service to other equipment. This protection is especially valuable on production lines using numbers of portable tools. Triploc plugs and receptacles are heavy duty types to withstand hard use. The complete range of types includes fusible plugs, cable connectors, and receptacles in many housing types with conduit fitting bodies in standard styles and sizes. Consult your Pylet catalog for complete listings of all types.

THE PYLE-NATIONAL COMPANY
1344 N. Kostner Avenue, Chicago 51, Illinois

ating voltages but becomes low resistance after the voltage has increased to a predetermined breakdown value. — G.G.D.

TO QUESTION 201—Your 110 volt d-c system is undoubtedly of the one leg ground type and the operator is receiving a very high inductive voltage "kick" through the push button. The e.m.f. of self inductance can be of the order of several thousand volts when a large d-c solenoid circuit is opened without a discharge resistor of some sort in parallel to act as a load and keep the voltage to a minimum.

We have found that the best protection for circuits of this type is the permanent installation of a Thyrite resistor across the solenoid. Thyrite is a trade name for a silicon carbide compound fired with a ceramic binder which has unique non-linear characteristics. The current varies through the material as a power of the applied voltage instead of directly as Ohm's Law would indicate.—M.D.P.

TO QUESTION 201—This d-c solenoid has a very strong field and when the circuit is broken, a very high voltage is set up dependent on strength of field and the speed with which it is broken. Because this voltage is high, it will tend to bridge the gap opened by pushbutton. I suggest that you build out the pushbutton with fibre. Expand the head enough to make it difficult for the operator to touch the case.

Another way of controlling this, is with a high resistor across the contacts.

—R.M.

TO QUESTION 201—A d-c solenoid is like the spring of a clock. When it is put across the line, energy is stored: the spring is being wound up. While it is on the line, nothing happens: the energy remains stored. When it is disconnected, the stored energy is suddenly set free; the spring is released. This recoil as we may call it is associated with a "kick," a short, high overvoltage. It is this overvoltage which shocked the operator, despite an insulation which is adequate for the operating voltage.

The analogy with the spring goes still further. The strength of the kick (the amount of the "e.m.f. of self-induction" as the highbrow calls it) depends on two quantities:

1. the number of turns
2. the rate of release

Were the energy released momentarily, the kick would be all-powerful. Actually, when the solenoid is disconnected, the current is not zero at once. While the contacts separate an arc is formed, and the current decays though rapidly but in a finite time.

Remedy is found by installing a Thy-

rite, or similar, resistor in parallel to the solenoid. Thyrite, a silicon composition, has the interesting characteristic to have a high resistance at low voltage, and a low resistance at high tension. When the overvoltage occurs, a high current flows momentarily through the resistor but at rated voltage, the continuous loss is tolerably small.—L.F.R.

TO QUESTION 201—The field winding on a d-c solenoid brake is highly inductive, therefore whenever the circuit is opened by pushing the push button, a very high back voltage is induced. This back voltage is also called the "voltage of self induction" and "inductive kick-back." In a large coil this voltage may reach a value of several thousand volts and this is the reason the operator receives a shock each time he opens the coil circuit.

The remedy is to use a field discharge switch and resistor. With this arrangement the discharge resistor is connected across the solenoid field coil whenever the switch is opened. The resistor now absorbs the energy in the solenoid field and prevents the back voltage from assuming a dangerous value.—P.N.

TO QUESTION 201—I had a similar problem, with a key socket and I traced it to a metal strand going through the moulded material, starting on the hot key and finishing on the surface. It is a rare occurrence.

Also check the solenoid discharge voltage arrangement which can consist of a copper oxide rectifier connected across the solenoid terminals in a manner to have its high resistance draw low current when the solenoid is energized, and its low resistance to keep the discharge voltage at a low value when the solenoid is de-energized.

Without a discharge arrangement, you get a very high voltage, when opening the circuit. Sometimes the normal voltage will not bridge the gap, but the discharge voltage will.—H.S.

TO QUESTION 201-You A have a very large solenoid and as a result have an extremely high value of inductance and hence stored energy. In opening the circuit with the pushbutton, the circuit must be broken, but before the circuit can be completely broken all the stored magnetic energy must be dissipated or gotten rid of. The only way is for the decrease in current flow to generate a back voltage that raises the voltage across the coil so that the arc can be maintained to dissipate the stored energy in the form of heat in the arc or heat due to the resistance of the coil. This may raise the voltage across the pushbutton to a very high value—so high that a voltage leakage or a capacitor current may flow, causing the operator to be shocked. The remedy would be to put a capacitor

Wagner Self-Centering Device **ENTS BRAKE-SHOE DRAG**

The new self-centering device on Wagner hydraulic bridge brakes prevents brake-shoe drag-thereby eliminating unequal brake-shoe wear and undue heating of the brake wheel.

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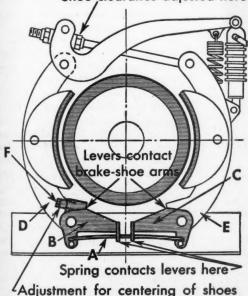
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It is simple in operation and requires no readjustments after installation. With the Wagner self-centering device, brake shoes remain centered irrespective of lining wear. It prolongs the life of the brake lining and reduces maintenance expense. Write for complete information. Wagner Electric Corporation, 6413 Plymouth Avenue, St. Louis 14, Mo.

Shoe clearance adjusted here



made here when brake is installed

against the two brake-shoe arms (D and E). centered at point (F) by means of a setscrew

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means of the setscrew may be necessary.

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across the terminals of the pushbutton. The capacitor would then absorb the stored magnetic energy of the solenoid. A resistor should be shunted across the capacitor to allow it to be discharged. The capacitor might also be connected right across the coil itself. Without knowing the characteristics of the solenoid, all I can say is that the capacitor should be relatively large. Another method would be to use a special switch such as a field discharge switch. This contains a contact so arranged that a resistor is connected across the solenoid as the switch is opened. The solenoid can then discharge through the resistor but the resistor will not draw current when the solenoid is on.-L.R.B.

DRAWING STATORS FROM CASINGS

UESTION 202-I would like to know the methods used by electrical repair shops to draw stators from the casings of electric oscillating fans, 16 inches and smaller. Due to cords breaking where they enter the casing, it is desirable to remove the stator (which is pressed into the casing) without damaging the winding. I have done this by tapping the holes (through which the assembling rods pass) with a 10-24 tap and using a piece of 43 inside diameter seamless steel tubing, and a 1 inch steel plate drilled to match these holes, the seamless steel tubing being 3½ inches long and making draw bolts 5½ inches long threaded 1 inch (10/24) on the end screwing into the stator and 31 inches of thread on each bolt for drawing purposes. This method is a very slow and laborious one. The same bolts are used for drawing the stator back into the casing after a new cord is attached. Above given dimensions apply to 16 inch fans.-H.C.S.

TO QUESTION 202—I mount the casing on a steel tube. Then a 1-inch steel plate drilled and tapped inch to match the assembly rod holes of most motors.

This I mount on a press which makes quick work of it. For assembling, I place the 1-inch plate on the other end of the stator, but I use shorter pins.—H.S.

TO QUESTION 202—Make an expanding sleeve to fit the bore and then any arbor press can easily push the core out and in.

It is a good plan to knurl the sleeve so that a friction is created.—E.J.K.

A-C GENERATOR APPLICATION

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UESTION 203—We have an application involving an a-c generator with its switchboard located at a distance of about 75 feet from the generator. There are 6 leads to be run from the generator to the switchboard so that the connections can be made delta at 2300 volts or wye at 4000 volts.

The generator is rated 300 kw. at 80 percent power factor, 2300/4000 volts. What I would like to know are the formulae for deter-

mining:

1. The kva. rating of the machine.

2. The armature currents when connected delta.

3. The armature currents when connected wye. (This is a revolving field generator).

4. The line currents both to the switchboard and beyond the switchboard when connected delta.

5. The line currents both to the switchboard and beyond the switchboard when connected wye.—G.S.F.

TO QUESTION 203—I take the rating of the generator, 300 kw. at 80 percent power factor, to mean that the generator has the capacity to supply 300 kw. of true power to an inductive load having a power factor of 80 percent.

In this case, the apparent power or kva., that can be supplied by this generator is 300 divided by .80 or 375.

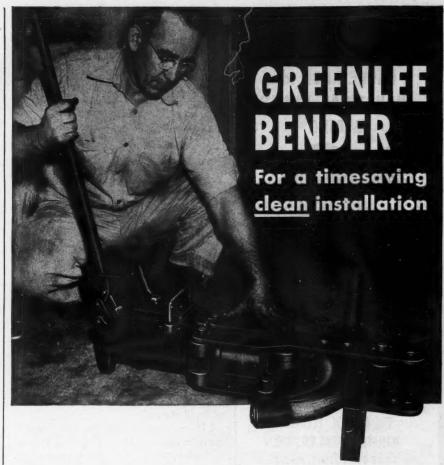
If the windings are connected delta, in which case the voltage generated is 2300, the total single phase equivalent amperes that can be delivered by the generator is obtained by use of the simple formula: watts divided by volts equals amperes or 375 divided by 2.3 equals 163.

Each of the three wires beyond the switchboard will carry 163 divided by 1.73 or 94 amperes but since there are two wires per phase running to the switchboard from the generator, each of those wires will carry one half of 94 or 47 amperes, when the generator is fully loaded.

When connected Star (Y), the voltage generated is 2300 times 1.73 or 4000 as stated in the problem.

Since the kva. value remains the same, the total single phase equivalent amperes in this case are watts divided by volts as before or 375 divided by 4.0 which equals 94.

The amperes per phase are 94 divided by 1.73 or 54. Since two coils are connected in series by wires running to the switchboard, each wire must carry



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the same current as the two coils in series and therefore all wires both to and beyond the switchboard will carry the same value of current, namely, 54 amperes.—B.A.S.

A TO QUESTION 203—Answers follow in order for the several questions:

1.
$$kva. = \frac{kw.}{pf.} = \frac{300}{.80} = 375 \text{ kva.}$$

2.
$$I = \frac{kw. \times 1000}{3 \times E \times pf.}$$
 or $\frac{kva. \times 1000}{3 \times E}$ line

Full load current at .80 pf.
$$=$$
 $\frac{375 \times 1000}{3 \times 2300} =$ $=$ 54.3 amperes

3.
$$I = \frac{kw. \times 1000}{1.73 \times E \times pf.}$$
 or line
$$\frac{kva. \times 1000}{1.73 \times E}$$
 line

Full load current at .80 pf.
$$= \frac{375 \times 1000}{1.73 \times 4000} = 54.3 \text{ amperes}$$

4. Line currents from machine to switchboard, formula and currents same as for 2 above.

Line current beyond the switchboard, formula same as for 3 above. Full load current at .80 pf.

$$=\frac{375 \times 1000}{1.73 \times 2300} = 94.2$$
 amperes

5. Same as 3 above. Full load current at .80 pf.

= 54.3 amperes.

-R.M.B.

TO QUESTION 203—It is assumed that the terminals of the motor coils are all marked so as to eliminate the chance of error. In case of the delta connection, it will be well to check with a double range voltmeter and potential transformer before closing the delta connection. Should one coil be reversed, a short circuit would result. If the six leads are carried to the switchboard these leads will carry the phase or armature current regardless of connection.

Assuming balanced load, each coil will carry one-third of the total load. In a 3-phase circuit (balanced) the power is figured as $W = \sqrt{3}$ EI cos ϕ , where cos ϕ is the power factor. To get value in kilowatts, the equation will be

$$kw_* = \frac{\sqrt{3} EI \cos \phi}{1000}$$

This is also $kw_* = kva_* \times \cos \phi$ or $kva_* = kw_*/\cos \phi$

1. The kva, rating of the machine will be $\frac{300}{8} = 375 \text{ kva}$.

2. The armature current for each phase when connected delta will be

$$\frac{kva. \times 1000}{\text{Voltage phase}}$$
 per phase

$$kva.$$
 (phase) = $\frac{\text{Total } kva.}{3} = \frac{375}{3} = 125 \ kva.$

Current =
$$\frac{125 \times 1000}{2300}$$
 = 54.4 amp.

3. The armature current will be the same when connected wye.

4. The line currents (for the delta connection) to the switchboard will be equal to the armature currents since the armature leads are carried directly to the switchboard. Current will be 54.4 amperes.

The line currents beyond the switch-board for the delta connection will be $54.4 \times \sqrt{3} = 94$ amp.

5. The line current to the switchboard (for the wye connection) will be the same, since the individual leads are carried to the switchboard, as in the case of the delta connection. (54.4 amp.) Since with the wye connection the coils are all connected together at one point and the lines are carried from the ends of the 3 coils the line currents from the switchboard will be the same, 54.4 amperes.

All these values are based on the condition of balanced full load of 300 kw. at 80 percent power factor or 375 kva.—J.E.W.

ELIMINATING GROUND AT KITCHEN SINK

UESTION 204—A suburban residence wired five years ago has developed a ground in kitchen sink when it is full of water (not noticeable at any other time). Wired with Romex, a good job, porcelain boxes in basement, well soldered and taped joints, where checked. Water pump is located in damp room with cement slab roof, attached to, but outside, house. Though trouble might come from there, the ground still persisted with that circuit disconnected.

Can anyone suggest a method of locating without disconnecting each circuit and then running it down?—C.N.

TO QUESTION 204—A few years ago I had occasion to work on a case of trouble identical to that encountered by C. N., in which shocks were felt when the hands were immersed in water, especially the stream of water from the faucet.

C. N. is looking for the water pipe to be of higher than ground potential when this is almost impossible with present day multiple secondary grounds. What I found, and C. N. will probably find the same, is that the sink and drain pipe are energized above ground potential.

Connection to ground in the drain pipes is usually poor due to the tarred pipe or oakum joints, or possibly tile pipe is used for a portion of the drain system. This would prevent a fuse from blowing.

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In my case, the BX armor had pulled out of a connector at the ceiling light in the kitchen below and a defective switch energized the armor and in turn energized the soil pipe with which it was in contact when the switch was on.

C. N. should look for a section of Romex caught on or touching the drain pipe or possibly the sink support bolts in the wall or floor.—A.S.A.

TO QUESTION 204-I connect A a 2000 ohm per volt voltmeter between the drain pipe, and the water pipe, or whatever shows a voltage drop. I shut the main switch hot leads, but not the neutral, to find out if the hot lead is not coming from a neighbors main switch, to the drain, and to your sink. (Without water in the sink, the sink may be insulated by means of gaskets.) If the ground is in the building, I try to feed ½ amp. through the fault, and then trace the ground by means of an exploring coil and headphone. If it draws less than ½ amp., I must disconnect each circuit, till the indication stops. Then I cut the leads at every sixth outlet till the indication stops.

I have used this system many times on grounds having resistances up to 2,-500,000 ohms. If you have a lot of this work, you can get a high voltage wheatstone bridge and use the varley loop circuit.—H.S.

TO QUESTION 204—The fact that the charged condition is noticeable only when the sink is full of water suggests the possibility that the potential source is the drainage system. The drain usually is insulated from the sink by a rubber washer or some other packing. When filled with water a connection is completed to the sink proper. As this is a private water supply system, it is quite possible for a high resistance to exist between electrical ground, (if other than water system) water and drainage system—A.J.L.

CHARGING BATTERIES

UESTION 205—About 18 months ago, we purchased two dozen wet batteries to take the place of hard-to-get flashlight dry cells. We also purchased a six unit copper oxide



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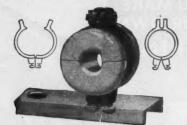


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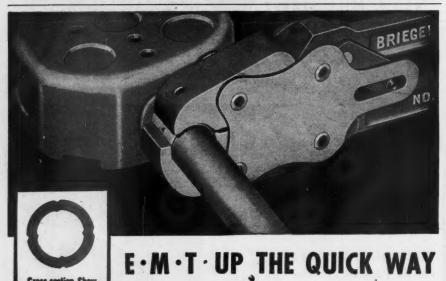


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rectifier for charging the batteries from the same company.

After the batteries had been in service for about six months, we noticed one or two of them cracked. We assumed this to have been caused from rough handling; but, as more casings cracked, we proved this was not the cause. Some of the batteries that haven't cracked will not take a satisfactory charge when placed in the charger. The pilot lights burn only about one half as brightly as when a good battery is placed on charge.

Our electrolyte is a dilute sulphuric acid (H2SO4). Can anyone tell us the cause of our trouble and the remedy?

TO QUESTION 205-The • cause can be: Too rapid charging or discharging. Over-charging and over-discharging. Use of too light or too dense electrolyte. Use of impure electrolyte. Badly designed or assembled batteries.-H.S.

Can you ANSWER these QUESTIONS

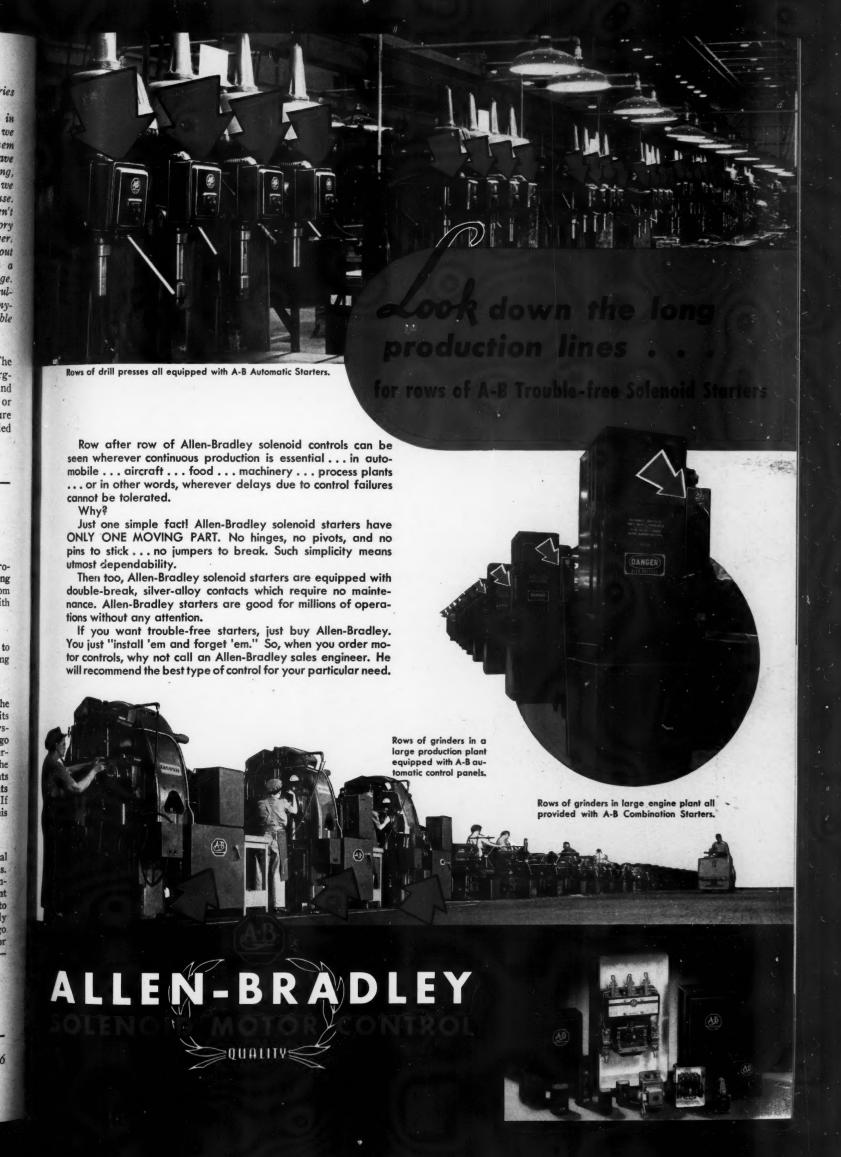
QUESTION Y8 -How can I reduce the stroboscopic effect of a fluorescent lighting installation? Our service is supplied from one single phase 60 cycle transformer with a 230/115 volt secondary.-T.B.

QUESTION Z8 -Can thermostats be used to cause an alarm, before hay starts burning due to spontaneous combustion?-H.S.

QUESTION A9 -How much current does the neutral wire carry when all light circuits are balanced on a 4-wire 120/208 volt system? Answers received some time ago indicated that the neutral carries no current. It is found that by disconnecting the neutral on a balanced system, the lights will dim as the effects will equal two lights on 208 volts or 104 volts to the lamps. If neutral carried no current, why should this take place?-L.G.D.

QUESTION B9 —We have in service several 20 hp.—1800 rpm.—silp ring motors. The rotors are bar wound and are connected series star. Because of insufficient testing equipment, it has been necessary to depend on our eyes alone to find badly soldered rotor clips, or those about to go bad. Have any of the readers run into or built a tester to detect the above trouble?— H.P.H.

PLEASE SEND IN YOUR ANSWERS BY FEBRUARY 1





BULLETIN 609 Manual Starters



BULLETIN 709 Automatic Starters



BULLETIN 712-713 Combination Starters

Double Break Silver Alloy Contacts There is no contact mainte-

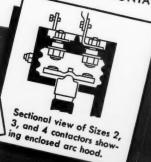
nance with these 3 popular lines of starters, All Allen-Bradley starters are good for millions of trouble-free



operations. This is due to the simplicity of construction of the individual switching units. They are unusually rugged

NEVER CLEAN . FILE . OR DRESS THESE CONTACTS





ALLEN-BRADLEY

when the cows were watered automatically. If full credit can be given the water system, it means that automatic watering has saved 44.4 minutes for every 10 gallons of milk produced.

With continuous water before cows in water cups it was found an average of 10.6 gallons of water was consumed per day per cow and that the average milk production per day from 11 cows was 221.62 lbs. When the cows were watered twice a day by hand these were 69 gallons and 216.10 lbs respectively. The cows consumed 53.6 per cent more water and produced 2.55 per cent more milk a day when water was continuously before them. Based on milk production during the winter of 1944 and figured on the basis of the 5 months, the use of water cups would have increased the milk income \$36.35.

The total cost of the entire water system was \$282.07 and it makes a direct saving of 17½ days work or 175 hours during the 5 winter months. Valuing labor at 64 cents per hour which was actually received from labor on the Motz farm during 1944, the time saved alone would be worth \$112.00. Add to this the increased milk check of \$36.35 and the total represents the yearly value to the Motz' family if they utilize the time saved to increase the volume of the farm output. The pump power consumption is .397 kw. hrs. per days. At 3 cents per kw. hr. the 5 months pumping would cost \$1.79. The depreciation would be 7 per cent of \$282.07. Allowing \$5.00 per year for maintenance, the net per year by using the water system for the dairy would be \$121.82. Based on this the water system as used for the dairy would pay for itself in a little over two vears.

The records further revealed that the family annually carried 10.76 tons (258,126 gal.) of water to the home for drinking and cooking purposes, covering a distance of 49.21 miles to accomplish this task. Future plans call for piping the water to the home to eliminate this arduous task.

A complete analysis has been made of the farm accounts to determine the weak points as well as the good factors in the over-all farm operations that might be used as a guide for improving the 1945 operations. A summary of the labor distribution and enterprise contribution to the farm profit appears in Table I. One of the farm accounts is



on outdoor lighting . . .

Perhaps you've wondered why these Goodrich reflectors are seen in tens of thousands of locations. The answer is easy—when you know the facts. Their original designs and high efficiencies have set the standards for modern high intensity illumination.

But the preference of experienced users is based on more than design alone. Sturdy construction is important—so are the cast aluminum mountings which protect against corrosion. Permanent porcelain enamel finish defies all kinds of weather—retains its high factor of reflection through the years. Easier installation, easier wiring, easier servicing are all a part of it. For these are important when you invest in lighting equipment.

Whatever your specific problem in outdoor illumination—from lighting a small sign to a big league park—Goodrich has the answer in a complete line that includes dozens of sizes and styles of reflectors. Goodrich engineers will gladly recommend those best suited to your needs. Write us.

Sold Through Electrical Wholesalers

GOODERIC COMPANY
4600 BELLE PLAINE, AVENUE, CHICAGO 41, ILLINOIS



Smooth, faster making and breaking of contact, accurate action... less friction . . . longer life. Here are more reasons for specifying Federal starters:

- Double break pure silver contacts held by a single screw for ready replacement.
- Heavy arc barriers located for strength, flashover resistance, high arc rupturing.
- Molded parts have asbestos base with non-carbonizing inorganic binder.
- Coils readily changeable—just remove retainer spring, loosen yoke, take out magnet.
- Overload relays combination hand and automatic reset. Bimetalic type. Originated by Federal.
- Heaters frontmounted, accessible: trip ampere stamped on units.

Send for your copy of the FEDERALOG.

FEDERAL ELECTRIC PRODUCTS COMPANY, INC.

EXECUTIVE OFFICES: 50 PARIS ST., NEWARK 5, N. J. + PLANTS: HARTFORD, CONN. - NEWARK, N. J.

that of electric power which was available during the last eight months in 1944. A review of the time saved because of its use shows the following.

MAN-HOURS SAVED ITEM Water System

35 hours per month pumping water and watering cows-2 months Sharpening Sickles 12 sickles, 1½ hours each......

18

Washing Clothes 3 hours saved per week. 12 hours per month, 8 months 96

Ironing 1 hour per week, 4 hours per month, 8 months 32

3 hours saved per month cleaning and filling lamps, 8 months 24 Cleaning Wheat 5

TOTAL 245

A total of 245 man-hours was saved during the first 8 months use of electric power at a cost of \$44.10 for the electrical energy. In other words, electricity was "hired" at a cost of 18 cents per man-hour. The over-all farm operation gave a labor return of 64 cents per man-hour; therefore, the electricity netted 46 cents to the operation for every hour saved. This net saving did not come directly to Mr. Motz and his family in the form of money, but it made it possible for them to handle their crops more timely, give more attention to their livestock, perhaps do certain jobs that otherwise would have been neglected. Also, it helped relieve some of the drudgery so more thought could be given toward organizing the farm operation for greater efficiency and, let us say, a fuller farm life.



Cornered by two Chicago electrical contractors, E. L. Reeve (left) and Emil DeHaan (right), Arnold H. Friend, treasurer, M. B. Austin Co., Chicago, evokes their smiles with a witty story at recent Western Section Electrical Inspectors meeting.



Quick installations are accomplished—economical results are realized—short-proof and shockproof qualities of porcelain contribute to dependability—rust and corrosion resistance characteristics make porcelain the ideal material in damp, wet, or dry locations—meets future load increases—allows for easily made alterations and additions.

6

4

* ILLINOIS ELECTRIC PORCELAIN CO. Macomb, III.

advantage of permanency.

PORCELAIN wiring is as modern as tomorrow, yet it has the oldest service record. It affords the contractor greatest flexibility in wiring — it is adaptable to practically all wiring plans and layouts — it gives contractors full independent control over the electrical characteristics and workmanship of the installations.

* PORCELAIN PRODUCTS, INCORPORATED Findlay, Ohio



MODERN PORCELAIN PROTECTED WIRING SYSTEMS

SHORT CUT

BUILD SUPPORTS-FRAMES On the job!

for BUS BARS and DUCTS, CABLES, CONDUITS, ELECTRI-CAL EQUIPMENT... without Drilling, Riveting or Welding

On all sorts of electrical jobs you can build frames, hangers, supports, without any drilling, riveting or welding... with UNISTRUT. Only three quick, easy steps. 1. Cut UNISTRUT to desired length. 2. Locate fitting and nut at desired point. 3. Bolt securely with a turn of the wrench. So simple! So fast! UNISTRUT saves time and money... 100% Adjustable and Re-usable. Made in four sizes and three gauges. Find out today about this short cut.

THE ALL-PURPOSE METAL FRAMING

Send for this FREE Bulletin showing 101 USES for UNISTRUT

Cable and Conduit Supports . . . Bus bar supports, hangers, etc. . . . Switch and panel board supports . . . Motor Starter and switch box supports . . . Motor bases, adjustable . . . Bus and switch cell structures . . . Power Duct System supports Outdoor and Indoor sub-stations . . . Disconnecting switch and barrier supports Lighting system supports

Stocks in Chicago, Detroit, Los Angeles, St. Louis, San Francisco



Representatives in all principal cities



UT PRODUCTS CO.

1013 W. Washington Blvd. . Chicago 7, Ill.

Need supports for cables or wiring . . Use UNISTRUT . . . makes 'em in a hurry!

UNISTRUT consists of (A) spring-held nut attachments with teeth which bite into the turned-in edges of hollow-square section and hold attachments in any desired position; and (B) slotted

Need motor bases in a hurry? Or supports for

electrical instruments or equipment? You can have

hollow square steel member.

them, pronto, with UNISTRUT.

Pipe clamp straps are inserted as shown at any point or points in the UNISTRUT member, insulators placed against the cable or conduit. A single bolt clamps insulators around the conductor, and locks the whole installation tightly to the UNISTRUT member.

UNISTRUT cable clamps, porce-

lain or maple, for conduit or cable, are used with stand-

ard UNISTRUT.

E

MOTOR SHOPS

ROUTING AND FOLLOW-UP ON SMALL JOB ORDERS

Jobs on small equipment written up at the service counter of the California Electric Works, San Diego, Calif., are routed systematically to avoid confusion and delays. After writing up, the jobs are placed in a series of bins, alphabetically arranged, a special section being set aside for government work and special overtime work.

From these bins, the jobs are assigned to the various men according to their ability and knowledge of certain types of work. After testing, if they require rewinding or special machine work, they go to those departments.

Those going to the general shop are put into separate boxes or trays in a long line of bins. All parts pertaining to the job are in the box. These bins are also alphabetically arranged, and the shop foreman assigns each job box to some one man in his department.

When completed, the jobs go to the "will call" counter. At that point the telephone operator assumes "control." She takes an interest in the work and has practically eliminated the nuisance of having completed jobs waiting around sometimes weeks or even months for the customers to get around to pick



Small motor department at Fagan Electric Co., Little Rock, Ark., is located practically in the center of the shop. Operating as a separate unit—with its own mechanics, equipment and materials—it handles all small work that comes into the shop.

Her procedure is to check each day the "will call" as they reach the counter. She makes a list and revises it daily or even more frequently, and starts telephoning each customer as soon as his job is ready. If a telephone call on any item does not get quick results she calls again, and in fact several times more. Failing to get the customer there by telephone, she starts a campaign of postcard follow-up. As a result of her activity and interest, a "will call" counter no more than 10 feet square is all that is required now, and there are almost no jobs standing around for more than a

SPEED CONTROL FOR COIL TAPER

Making use of available equipment during the war, to perform operations other than that for which it was designed, was a specialty of the Evans Motor Repair Shop, Utica, New York. Adaptation of a high speed motor to a coil taping machine is one typical example to be found in their shop.

A 900 rpm. motor was needed for powering the coil taper. Due to the shortage of motors, and War Production Board restrictions and regulations, it was impossible to obtain a motor of the right size and type. For the Evans shop, however, this was not a serious problem. They had on hand an 1800 rpm., ½ hp., single phase, 60 cycle, 110 volt alternating current motor, and proceeded to adapt this motor for use with

The taping machine was installed on a heavy work table, and holes drilled in the table for the pulley belting of the taper. The available motor was then installed under the table top, strapped to a heavy wood member. A jack shaft with large pulley was used between the small motor pulley and a small pulley



Small-job orders reaching the general shop are all contained in separate boxes or trays, with parts. These are alphabetically arranged and the foreman goes over them and assigns them to the various men. Everything is thus kept together relating to each job until it is completed and passes on to the "will call" counter.



Install an Outlet WITH EVERY LIGHT SWITCH

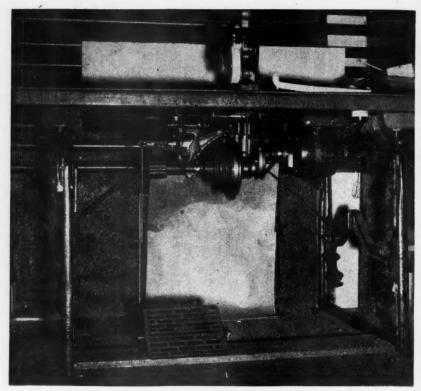


This extra convenience costs only a few cents more. Then, if an outlet is needed, there it is — right at a convenient height. It takes up no extra space — Two (or even three) P&S-Despard devices can be installed in the same space required for one old style switch. For replacement work, the same single gang box can be used. If you are not already acquainted with the possibilities of Combination Wiring — the P&S-Despard way — send for a copy of our catalog.

Sold through Electrical Wholesalers.



PASS & SEYMOUR, INC.
SYRACUSE 9, N. Y.



Jack shaft is used to reduce speed of an 1800 rpm. motor to 103 rpm. on taping machine head. Inability to obtain slow speed motors during the war made it necessary to use this rig, in order to utilize a standard rated motor which was available.

attached to a pressure clutch, thus reducing the 1800 rpm. motor speed to 103 rpm. for the taping machine head.

The pressure clutch is used to vary the speed of the taping machine head, and is operated by foot treadle.

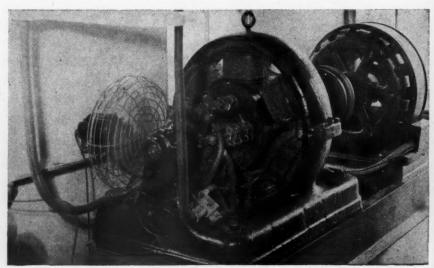
EMERGENCY SET

On a war plant job, a motor-generator set was required to deliver 1000 amperes at 25 volts, for the purpose of annodizing rivets to make the surface non-conducting and so prevent electrolytic action. The problem of producing this equipment was put up to the Meller Electric Co., Huntington Park, Calif., at a time when the scarcity of equipment was at its worst.

Mr. Meller solved the problem by re-

course to what was practically the junk pile. An old wood d-c generator, 500 ampere, 50 volt, that had formerly been used in telephone work was secured and rebuilt to the desired output characteristics. This is driven by a 40 hp. CCL Westinghouse motor reconditioned.

To keep the commutator cool, a heavy duty fan was installed as shown in the photograph. The installation saved the customer four months time on delivery, and for the first six months, at least, operated 24 hours a day.



Fan holds down temperature on old-time commutator.



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46

Installing the urge for continuous electrical change

The tenants are going to have Q-Floors. This means they will have the urge to rearrange floor plans as frequently as changing conditions dictate.

Q-Floors are built specifically to permit electrical change. Any six-inch area of the floor can be drilled for an outlet. This encourages tenants to keep their floor plans up to date and to use the latest electrical equipment.

Change requires an electrician's service. New outlets require an electrician's service.

Q-Floors promote electrical service.

H. H. ROBERTSON COMPANY

2400 Farmers Bank Building, Pittsburgh, Pennsylvania



Offices in 49 Principal Cities World-Wide Building Service

Electrical Fittings for use with Robertson Q-Floors can be obtained from General Electric Construction Materials distributors. See the nearest G.E. merchandise distributor for information on how Q-Floor fittings can be used to attain up-to-the-minute electrical wiring.

THIS IS T SQ. FT.



-FLOORS



- Open or closed end, life-long porcelain enameled steel
- Fixtures available for two and three 40-watt or two

plete details?

Day-Brite Lighting, Inc., 5401 Bulwer Avenue, St. Louis 7, Mo. Nationally distributed through leading electrical supply houses.

In Canada: address inquiries to Amalgamated Electric Corporation, Ltd., Toronto 6, Ontario.

IT'S EASY TO SEE WHEN IT'S

#Patent No. D-142488

MODERN LIGHTING

ARMOUR RELIGHTS GENERAL OFFICES

What is reputed to be the largest commercial fluorescent installation in the Chicago area since prewar days is nearing completion at Armour and Company, one of the country's largest packing plants. The entire office area comprising six floors of an E-shaped building (constructed in 1912) is being relighted—this time with approximately 1300 Mitchell, 4-lamp, 40-watt, URC fluorescent lighting fixtures. Twice before, during the 33 year period, the lighting system has been revamped to conform to the then established lighting standards.

Ever conscious of the part that good lighting plays in efficient operation, Armour management and engineers established four basic considerations when the relighting was planned:

1. A 40 footcandle uniform illumination level at the desk top.

2. Freedom from disturbing glare.

3. A comfortable fixture brightness.

4. A light ceiling free from alternate light and dark areas.

The existing lighting offered none of these advantages. It was a now outmoded, enclosing globe, semi-indirect, incandescent system providing spotty general illumination of about 6 footcandles average on the working plane. In general, four 300 watt fixtures were mounted 9-ft., 6-in. above the floor on

approximately 9-ft., 6-in. spacing, in each 10-ft., 6-in., by 17-ft. bay formed by supporting beams. The over-all ceiling height is 15-ft., 8-inches.

With the management's basic considerations in mind, Armour engineers worked in conjunction with General Electric and Commonwealth Edison Company lighting specialists while designing the new lighting system. All angles were carefully studied from an engineering and economic standpoint. The possibility of increasing the incandescent system to a 40 footcandle level was rejected. The demands of such a design would exceed the wiring capacity of the building and, due to heat radiation of the lamps, would throw the air conditioning system completely out of balance. New wiring and additional air conditioning capacity would be necessary. Furthermore, direct incandescent lighting of the desired intensity would produce objectionable fixture brightness and disturbing glare on the working surfaces. The 15-ft., 8-in. ceiling height was unfavorable to an indirect incandescent system.

Both types of fluorescent lighting—hot and cold cathode—were studied. Cold cathode was eliminated primarily because there were no diffusing fixtures available and a bare lamp installation was not desirable. That left the hot cathode, or conventional, fluorescent light source to be analyzed. Fluorescent troffers were considered, but the cost of installing suspended ceilings throughout

all the areas precluded this choice. Also the brightness contrast on the ceiling with fluorescent troffers was more than desired.

After considerable study and analysis, the engineering group chose the Mitchell URC unit with the four 40 watt, 3500 degree white lamps. The layout designed to secure the necessary maintained 40 footcandle intensity comprised parallel rows of fixtures (three units per row mounted end-to-end) mounted direct to the new acoustic tile 'ceiling (old acoustical treatment replaced). Each bay contains two rows of units, on 9-ft., 6-in. centers, parallel to the major axis of the bay. The same spacing exists between fixture rows in adjacent bays. With this arrangement, existing outlets were utilized to serve the fixture rows. The six fluorescent units per bay (two rows of three each) totalled 1200 watts, the same as under the old incandescent system. No additional circuit capacity was necessary and there was no appreciable increase in the total connected lighting load for the building.

The same type of fixture was installed in the private offices. Here, however, the units were mounted end-to-end in rows parallel to the length of the office, regardless of the fixture pattern in adjacent general office areas.

From a maintenance viewpoint, Armour reports that experience with an installation of similar units in a Sioux City, Iowa branch office revealed no unusual problems. Based upon the



The old lighting with enclosing globe incandescent units provided a spotty six footcandles average of illumination on the desk tops.



Relighted, the same general office area, has a more pleasant working atmosphere. The comfortable fluorescent illumination reduces eye strain and fatigue.



FLUORESCENT LAMP BALLASTS

Complete range of sizes for all lamp applications. Quick-start and standard designs. Bottom lead, end lead, universal lead types.



BALLASTS AND TRANSFORMERS
For all standard sizes of Cold Cathode and Slimline tubes as well as custom built tubing.

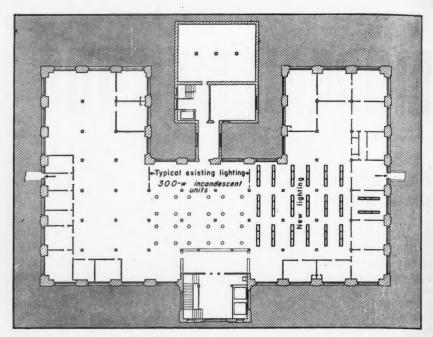


AIR COOLED POWER TRANSFORMERS

From 1/10 KVA to 50 KVA, auto and insulated types single and three phase to 2400 volts primary

THE ACME ELECTRIC & MFG. CO. GENERAL OFFICES; CUBA, N.Y.

Acme Flectric



Plan view of typical building floor showing fixture locations under the old and new lighting systems.

well established fact that any lighting system requires systematized maintenance to assure efficiency, Armour engineers are devising a program to meet their needs.

The new lighting was installed floor by floor by the Fries-Walters Electric Company, Chicago electrical contractors. To illuminate the 100,000 square feet of office space on the first five floors of the building, 1132 fluorescent fixtures were required. With the sixth floor now being revamped the fixture total will approximate 1300, all of which were distributed by the manufacturer through the Graybar Electric Company in Chicago.

With the office employees now working under a modern, evenly diffused 40 footcandles illumination system, Armour and Company posseses one of the best lighted office buildings in the packing plant industry.

the open hatch of the ship and directed into the hold.

Spill light from the floodlights, when mounted high over the ship's hold, provides ample lighting for the docks as well.

The resistor consists of six 12-ohm nichrome wire resistors (porcelain base) mounted in a frame. The lower voltage service reduces danger from shock. The resistor and the heavy duty floodlight combine to provide the tools for a new floodlighting application.

For many years the coal and ore industries have used a very hazardous method of lighting the hold of a ship so that the bridge operator could see

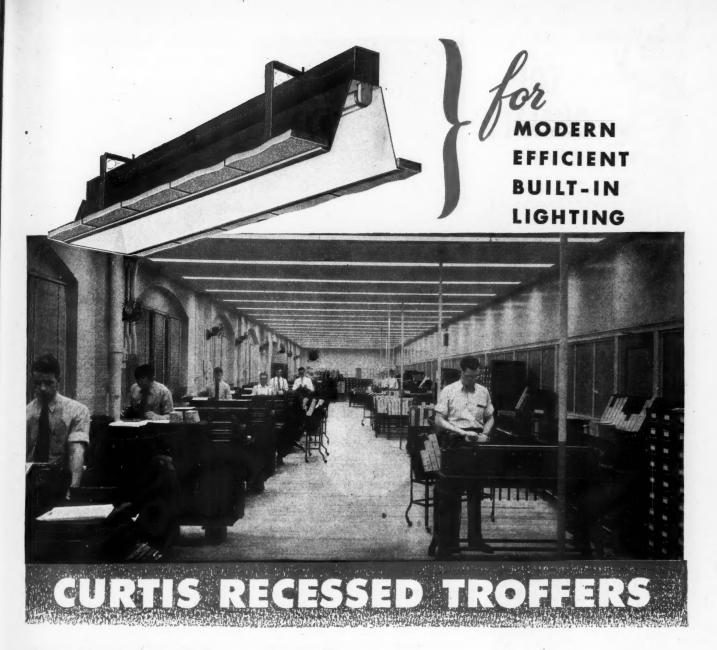


The holds of this Great Lakes freighter are lighted by floodlights using 1000 watt lamps operated at 230 volts d-c, which are mounted on the end of the rig's boom. Better lighting results, and hazards of the old practice of using lamps on portable cords in ship's hold are eliminated.

FLOODLIGHTING DECREASES SHIP LOADING HAZARDS

A new method of floodlighting ship loading and unloading operations has greatly increased production. It has also decreased danger from unseen hazards, and from wiring practice followed in the past.

This new method, reported by C. H. Peiffer, Westinghouse Electric Supply Company lighting specialist in Milwaukee, makes use of a special 1000 watt floodlight for 230 volt operation, and a resistor for reducing voltage from 600 volts d-c to 230 volts d-c. The floodlight, equipped with a hinged gasketed cover to make it practical for coalyard service, is swung on the end of a rig boom. Thus, the light is always over



Curtis one lamp fluorescent Troffers are excellent for office lighting and a variety of other interiors. They are particularly suited to low or suspended ceilings.

Scientifically designed by Curtis engineers to eliminate high brightness, the sloping reflector sides of these units, together with Curtis Fluracite finish brings exceptionally high lighting efficiency. This has made the use of diffusing glass panels unnecessary, resulting in exceptionally low maintenance cost and higher average light output.

The appearance of these troffer units when installed is very pleasing and the ceiling effect is smooth and interesting. Shielding is 45° crosswise and a one-piece louver (optional) provides 30° longitudinal shielding. These louvers are easily removed for maintenance.

AVAILABLE IN 40 and 100 WATT SIZES

Each 40 watt troffer section is exactly 48" long and fits into a 12" opening. 100 watt troffers are 60" long and fit a 12" opening. 12" is required for recessing labels.

For full details and specifications, send for data on Curtis Recessed Lighting.





TOP QUALITY

Mr. Tops, the Paragon symbol of top quality.

POULTRY HOUSE TIME CONTROLS

Here are two first quality Poultry House Time Controls. Paragon "PS" models are designed for both morning and evening lighting, with dimming period for roosting. The Paragon Model 301 is designed essentially for morning lighting only. It is a heavy duty, industrial type time switch adaptable to poultry house lighting.



Model "PS" for Morning and Evening Lighting

Model 301 for Morning Lighting Only



Send for Authoritative Bulletin

Paragon has prepared a 4-page, 2 color bulletin containing authoritative information relative to poultry house lighting control. It summarizes the recommendations of leading poultry authorities and gives complete data regarding the wide range of Paragon poultry house time switches. Send for a supply to distribute among your dealers and power companies.

PARAGON ELECTRIC COMPANY
710 Old Colony Building • Chicago 5, Illinois





Floodlights installed on end of rig's boom to light ship's hold also provides well lighted dock.

to lower his grab bucket into the hold. This method consisted of several portable cords, each cord having three 220 volt lamps in series on a 600 volt d-c service, the type of service supplied to about 90 percent of all coal rigs. This practice made it very risky for the operators, and quite a few men are reported to have been killed from shock while trimming coal from the grab bucket. Use of the resistor and floodlight located on the end of the rig's boom does away with the hazardous practice of using portables, provides better illumination where needed, and thereby reduces hazards while increasing the efficiency of the operators.

This combination unit should prove useful in solving other lighting problems where 600 volt d-c power exists.

CONTINUOUS FLUORESCENTS LIGHT OFFICE UNIFORMLY

The General Electric Company Lamp Department believes in the slogan "Practice what you preach." They know from their constant research that high intensity, quality illumination makes for more work output, less absentees, fewer errors and better employee relations. They not only preach good lighting, they provide it, too, for their employees, as exemplified in the new lighting installation in their St. Louis office.

The office contains a total of 1515 square feet of floor area. Its dimensions are 58 ft. 2 in. by 26 feet. The ceiling height is eleven feet. The ceiling is finished flat white, and the walls, including the venetian blinds, are finished in a light buff. This combination creates a bright, cheerful atmosphere, and increases utilization of light in this area.

Continuous row Guth "Futurliters," equipped with standard egg-crate louvers, were used to light this office. Three rows of fixtures, each a "line of light" 52 feet long, are spaced eight feet apart across the width of the room. Each row is made up of 13 four-foot long fixtures, which are suspended six inches from the ceiling to the top of the fixtures. Each four foot length is arranged for three 40 watt fluorescent lamps. Alternate units, however, are equipped with two lamps per section, resulting in a total of 18 two-lamp units and 21 three-lamp units. All lamps are 40 watt 3500° white. A total of 99 lamps are used in the entire area, and results in an average illumination of slightly more than 50 footcandles after 2000 hours burning. The total wattage, including ballasts,



Lines of light, spaced eight feet apart, provide over 50 footcandles of uniform illumination in the office area of the G. E. Company's Lamp Department, St. Louis office. A white ceiling and light buff side walls insure maximum lighting efficiency.



Outstanding in appearance. Smart in design , . . styled in perfect taste.

mp acow igh for

ver ns. ney as al-

he ills, non e, is

ee."

Functional . . .

Distinctive . . .

Scientifically engineered to give long and lasting performance at peak lighting efficiency.

Flexible . . .

Surface mounted . . . or suspension mounted with Hanger AH-200—individually or in continuous row.



leaders in the field of fluorescent luminaires. Like all leaders—they are outstanding for many superior characteristics... the result of 30 years experience in the design and manufacture of quality lighting equipment.

The Wilson, typical of this series, offers the utmost in beauty and utility. Scientifically and distinctively designed—The Wilson is adaptable to a wide range of applications.

Investigate the "Presidential Series" of Fluorescent Luminaires and the entire line of *Pittsburgh Permaflector* Fluorescent and Incandescent Lighting Equipment. *Pittsburgh Permaflectors* are engineered for maximum efficiency . . . simple installation . . . easy maintenance.

Pittsburgh Reflector Company

OLIVER BUILDING . PITTSBURGH 22, PA.

MANUFACTURERS OF PERMAPLECTOR LIGHTING EQUIPMENT DISTRIBUTED BY BETTER ELECTRICAL WHOLESALERS EVERYWHERE

Permaflector Sales Engineers in All Principal Cities

PERMAFLECTORS . SPOTLIGHTS . FLOODLIGHTS . WIRING DEVICES . FLUORESCENT EQUIPMENT



McGILL Safety Vaporproof GUARDS...with Tight-sealing Globes Approved by Underwriters No. 3002 for 60 watts

Safeguard Life and Property

Where there is a possibility of fire, or other disaster from a spark, exposed flame, heat or breaking of bulbs, then McGill Vaporproof Lamp Guards should be used on all portable or extension lights. The tight-sealing globe and heavy cage, with air-tight seal in handle opening, eliminate these hazards at every spot where this guard is used. These Vaporproof guards are designed to stand up under roughest use and abuse.

These guards also protect the light bulb and prevent breakage when used around machines where water and oil might splash on the bulb. Guards also are grounded — an additional safety feature.

Mc GILL

MANUFACTURING CO., INC.

Electrical Division

VALPARAISO, INDIANA

is 4727 watts, or 3.12 watts per square foot for this area, resulting in coefficient of utilization of 40 percent.

ENGINEERING DATA

Area1515 sq. ft. Ceiling Height 11 feet Mounting Continuous row units suspended six inches from ceiling Spacing Continuous rows are spaced eight feet apart No. of Units Three continuous rows, each row having 13 four foot units Type G u t h "Futurliter" units, for 3-40 watt lamps each, and equipped with eggcrate louvers Wattage4727 watts total, for 99-40 watt lamps and ballasts, or 3.12 watts per sq. ft. .50 footcandles, or an Intensity ... average of 16 footcandles per watt per sq. ft. .White ceiling and Comments light buff finished side walls are used. Coefficient of utilization is 40 percent.

LOW BRIGHTNESS CONTRAST OFFICE LIGHTING

More and more attention is being given to brightness factors in the planning of lighting installations. Not only should the maximum brightness be kept low, but also there should be a minimum of contrast between the brightest object and the areas of low brightness.

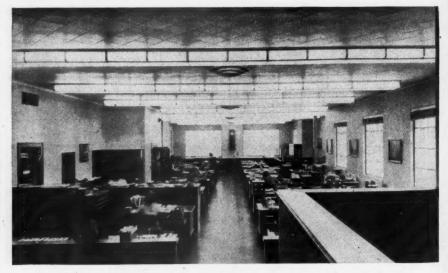
Brightness is measured in candles per square inch, or footlamberts. One candle per square inch is equal to 452 foot lamberts, the term which is becoming more prevalent, as it permits easy listing

of small differences in brightness. Brightness of light sources or lighting units has generally been measured in candles per square inch. Since the introduction of fluorescent light sources with much lower surface brightness on diffusing media used with fluorescent lighting units, it is becoming normal practice to measure these brightnesses in footlamberts. Brightness of objects which reflect light to the eye are normally measured in footlamberts.

An outstanding example of brightness-controlled planned lighting is an installation in the office of The Josten Company, Owatonna, Minn. The illumination intensity, measured two months after the installation was completed, averaged 50 footcandles at desk top level. Maximum brightness of the lighting units in the normal line of vision does not exceed 375 footlamberts, or less than one candle per square inch.

The ceiling in this office is natural color acoustical tile, with a reflection factor of approximately 75 percent. Side walls are painted a light tan, and have a reflection factor of about 60 percent. The low surface-brightness fluorescent units, viewed against the light colored ceiling and side wall background afford excellent visual comfort.

Lighting equipment consists of 60 individual four foot Guth direct lighting type units, arranged in continuous rows. These rows are ten feet on centers, and installed directly on the ceiling. Each unit is equipped with three 40 watt. 3500° white F lamps. Eggcrate type louvers, made of steel and finished white, provide 45° angle shielding. Specially selected low brightness curved glassware, fluted in design, forms an effective luminous shielded side for the units. Wattage required totals 3.15 watts per square foot to produce 50 footcandles of illumination, for an efficiency of 15.8 footcandles per watt per square foot.



Low brightness fluorescent direct lighting units, arranged in continuous rows spaced 10 feet apart, provide high intensity comfortable lighting in The Josten Company office at Owatonna, Minn.

"Continuous Line" Fluorescent

1. MATERIALLY INCREASES SCHOOLROOM SEE-ABILITY

2. IS EASILY ADAPTED TO ANY ARCHITECTURAL TREATMENT

3. IS ECONOMICAL TO INSTALL IN NEW OR EXISTING STRUCTURES

Architects, electrical contractors and school authorities may well be proud of schoolroom see-ability like this. Since 87 percent of all learning is visual, teaching, as well as learning, is faster, more efficient and a great deal more pleasant when it is the beneficiary of a well planned lighting system.

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Continuous line fluorescent lighting systems by Westinghouse rate high with both teachers and pupils. They like the higher intensity and quality of illumination that results from correctly designed equipment and efficiently engineered application.

PLAN of continuous line fluorescent lighting in average size schoolroom. Here twelve Westinghouse Type LW-160 luminaires (each equipped with four 40-watt lamps) increased the level of illumination from an inadequate 3.6 to approximately 40 foetcandles.

rom your nearest Westinghouse office. It contains a complete analysis of the engineering principles and costs involved in arriving at this excellent schoolroom see-ability.



FOR ASSISTANCE in preparing your school lighting recommendations, request the service of a Westinghouse Lighting Engineer. Contact any one of the 127 Westinghouse Electric Supply Company or Independent Distributors' offices nearest you, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

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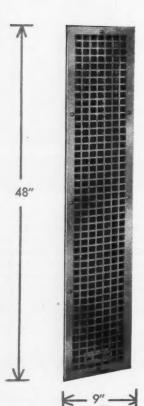




THE BUILT-IN FAN TYPE ELECTRIC ROOM HEATER*

Fills the room with a flood of air, less than 2 degrees difference between ceiling and floor temperature. Finished in Moroccan Brown or with primer which can be painted to match interior trim. Only 16" by 21", it can be installed between studs, and needs only 4" in depth. In summer, with the heating element off, and the fan on, this versatile heater floods the room with welcome circulating air. Manually or thermostatically controlled.

2, 3, and 4 thousand Watts, 230 Volts



THE "HEAD-TO-HEELS" ELECTRIC BATHROOM HEATER*

Sleek, slender and simple, this modern, fumeless, flameless bathroom heater can be fitted into any bathroom. It is 48" in height and only 9" wide, and needs but 4½" of depth. Since it is electric, it is installed without a flue or vent—heavy chrome finish, ceramic insulators. Made by Thermador, the oldest and largest electrical appliance manufacturer in the west.

1650 Watts—115 or 230 Volts 2000 Watts—230 Volts

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5119 SOUTH RIVERSIDE DRIVE-LOS ANGELES 22, CALIFORNIA

QUESTIONS ON THE CODE

GROUNDING CONDUCTORS

"In grounding outlet boxes in an ungrounded wiring system, is it permissible to splice the ground conductor from these outlets to a common grounding conductor which leads to the ground rod of water piping system?

"These outlets are located in 'wash rooms' and 'laundries' in a dwelling. The house is of frame construction. I am using two-conductor Romex without grounding conductor.

"Where is this found in the Code?"-RTD

The answer to this question is found in the wordings used in sub-paragraph a and b of Section 2591.

Sub-paragraph a (of 2591) requires that grounding conductors used to ground systems must be without joint or splice except in the case of busbars. These are the grounding conductors used to ground the neutral of an a-c supply system at the service equipment in a building.

In sub-paragraph b which governs grounding conductors used to ground equipment or conductor enclosures, this requirement is missing. Therefore splices or taps are permitted for such grounding conductors.-F.N.M.S.

ELECTRICAL EQUIPMENT

"We are having an argument concerning the type of electrical equipment for use in a room where paint dip tanks are being used. The electrician wants to use explosion-proof equipment, but we do not feel that this expensive equipment is necessary especially after having actual tests of the air made by an explosion meter. This test was made late in the afternoon after the paint dipping operation had been continuously conducted for seven hours, and the meter indicated less than 10 percent of the explosive vapor necessary for an explosive condition. We do not have an inspector to determine this for us, and we find it necessary to ask for your as-

sistance. Would you consider a room in which paint dipping operations were being conducted as hazardous?"-A.R.

This is more than just a Code A. question. In the first place, an explosion meter unless of the continual recording type might lead to a sense of false security as we only need an explosive condition for a fraction of a minute's duration during a day's or year's operation to destroy a plant. The facts which must be considered are amounts of hazardous liquids involved, their vapor density, flash point, room size and construction, and means of ventilation or air changes. After weighing these factors, if there seems any likelihood of even a small pocket of explosive vapors forming, it would not be safe to use electrical equipment other than that approved for use in a Class I Group D location. It is impossible to say definitely that a paint dipping operation is either safe or hazardous as each such operation is a separate engineering problem .- G. R.



Victor F. Knadler (left), Louisville, Ky., discussed his new position as chief construction inspector at the Kentucky State Reformatory with E. J. Stewart, chief engineer, Kansas Inspection Bureau, Topeka.

FARM WIRING

"One of our rural customers has purchased a 3 horsepower 220 volt motor to operate a small grain elevator on his farm. The present service to his granary consists of two No. 12 weather proof conductors supplying two light outlets and one duplex convenience receptacle. The service span from the distribution pole to this building is about 28 feet, so the No. 12 conductors would have ample capacity to furnish power for this motor provided a third conductor was installed. We have been told, however, that the Code would not permit this but are unable to understand why this would be dangerous. What are the actual rulings on this?"-J.A.L.

The National Electrical Code under Section 2305a states that service entrance conductors shall not be smaller than No. 8 except for installations consisting of a single branch circuit, in which case they shall be not smaller than the conductors of the branch circuit and in no case smaller than No. 12. Inasmuch as an installation serving a 220 volt motor and a 115 volt lighting circuit would obviously consist of more than a single branch circuit, this section would prohibit the use of service conductors smaller than No. 8 for the building in question. On properties under single management which consist of two or more buildings, it is possible to consider the conductors serving one or more of the buildings as feeders and not service conductors provided they are furnished proper overcurrent protection at a distribution panel or cabinet. Therefore on a farm it would be possible to locate a distribution panel on the yard pole and supply one or more of the buildings from it. If this is done, such supply conductors would be known as feeder conductors and feeders need only have sufficient current carrying capacity to supply the connected load. While such a subterfuge is possible, it could not be considered good practice on the average farm due to the fact that most farmers will require much more service capacity to their outbuildings than is usually available. A very large percentage of the

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Floor or wall mounting.
No extra brackets.
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Standard 75 KVA. 1-phase Floor Mounting Type

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farms already wired are faced with the necessity of replacing services to many of their buildings in order that use may be made of the many various labor saving electrically operated machines and appliances being developed for such use.—G.R.

UNIDENTIFIED CABLE

e"I have some armored cable with no identification (UL stamp) on it. I don't know what type of insulation is on the wire.

a. Am I allowed to use the cable?
 b. What type of rubber would you call it?"—L.S.

As armored cable leaves the factory (presumably as it leaves the supply house and arrives on the job where it is to be installed), it has attached to each coil one tag which identifies the cable as to its manufacturer, size of wire, type of insulation, voltage limitation, and one label showing listing by Underwriters' Laboratories. In addition, the cable bears on the outside of the armor the imprint of a trade mark or initials or symbol, identifying the manufacturer.

The one label however, is the only marking by which it may be known that the cable is "approved." Once the coil is open and the tag removed, there is no further way of ascertaining whether the cable is approved or not.

Because of the above, there is really no way of policing armored cable on a large job where many coils of cable are involved and where the coils may be opened before the Inspector can get on the job. Because of all of this and because of the lack of a satisfactory method of marking cable, Inspectors and others must assume the assurance of the Laboratories that all armored cable on the market is approved.

Up until the present time, all armored cable of the 600 volt class, has only Type R rubber insulation on the conductors. Other types will be available when the 1946 Code becomes effective in November, 1946.—F.N.M.S.

SERVICE EQUIPMENT

"We plan to wire a new mercantile building now being erected and are at a loss as to the proper location for the service equipment. Apparently no thought had been given by the architect, and as a result there is no part of the building which might be accessible to each of the four tenants. Does this mean that we will have to provide a master service switch within one of the stores with separate subservice



WRITE FOR DESCRIPTIVE BULLETIN ON THIS AND OTHER SPERO FLUORESCENT LUMINAIRES



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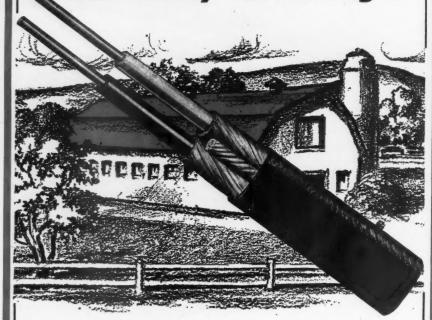
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TYPE TX

NON-METALLIC SHEATHED CABLE

Has Many Advantages



A SAFE, PERMANENT low cost cable for interior wiring. The use of SYNTHOL Type T conductors results in a smaller, lighter weight cable, which makes it easier to install and takes less space. The SYNTHOL thermoplastic insulation on the conductors has long life, high dielectric and mechanical strength, and is extremely resistant to moisture, acids, alkali and mildew. Will not burn and is free and clean stripping. Recommended for farm and rural buildings, as well as for all types of residential construction.

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WIRE and CABLE NEM



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TRENTON, N. J.

switches for each store? We understand that only one service drop may be made to one building from the same distribution system, but it seems that the owner will be required to spend several hundred dollars for a switch that does not serve any useful purpose."—R.K.T.

The Code provides an exception A to the rule regarding the number of service drops to a single building under Section 2321e. If you wish, you may bring the service drop to the outside of the building and run it along the outside wall. Individual services may then be placed in each one of the subdivisions of this building and connected to the service drop run on the outside of the wall. In masonry buildings, conductors two inches or more from the inside wall are considered as outside the building. Therefore it would be possible to either rack the service drop on the outside or they might be placed in a conduit run within the wall itself provided the wall is of masonry construction. However, if the building has a common space accessible to all occupants or if the walls dividing the building into individual units are pierced by doors, the services would have to be grouped in a single location or a master service switch would have to be installed.-G.R.

BRASS SHELL SOCKETS

"Inspectors have refused to approve brass shell sockets with 100 watt or larger lamps. Where is this found in the code?"—M.M.

It isn't. Inspectors who use such a ruling have found it the hard way—by experience and not reading it in the Code book. Where brass shell fibre lined sockets are used with 75 watt or larger lamps and the lamps hang downward, inspectors have found that within a comparatively short time the fibre linings have become carbonized and crumble away.

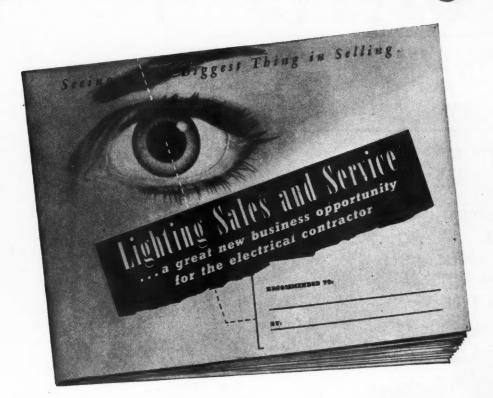
They therefore refuse to approve such work although they do not find the rule in the Code because they consider that a hazard exists and justly so.

They find that the same hazards are not presented when porcelain or bakelite sockets are used. With upright sockets conditions are not quite so bad.—F.N.M.S.

INSTALLING TRANSFORMERS

"In an attempt to lessen voltage drop, we plan to install a bank of 150 kva. transformers in the center of a rather large woodworking factory.

CONTRACTORS! Bigger Profits in Store Lighting!



A Billion Dollar Lighting Market Ready and Willing to Buy from You!

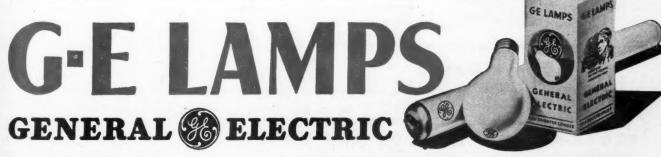
OU'RE the key man in the store lighting market. And General Electric has prepared a complete lighting sales program especially for you—the electrical contractor.

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- 4 the profit possibilities in store lighting sales and service
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Manufacturers of Oil Cooled, Dry Type, Power and Distribution Transformers Also All Types of Specialty Transformers Regardless of Size

The construction of this building is such that a regular transformer vault would have to be supported independently of the building structure so we want to avoid the expense if possible. If the newer type transformers using synthetic liquids are used, may they be located in the open with only screening about them to guard against persons contacting uninsulated parts?"—W.B.

Transformers using approved synthetic liquids that will not burn may be located within a building without being enclosed within a standard vault provided they comply with Section 4503b of the N. E. Code. In this particular case there is another factor which must be considered and that is the possibility of these units being located in a Class II location." If operations in the vicinity are such that fine wood dust is commonly found in suspension in the air, the transformer installation should be enclosed within a dust-tight room well ventilated to the outside and equipped with a self-closing door. If wood dust is not found in this particular location your plan for an open installation would comply with the Code. You will note upon referring to Section 4503b that such transformers when rated over 25 kva. must be furnished with a pressure relief vent, and when installed in a poorly ventilated room they must also be capable of absorbing any gases generated inside the cases or be equipped with vent or flue pipe connected to the pressure release vent which will carry released gases outside the building .-G.R.

KITCHEN FIXTURES

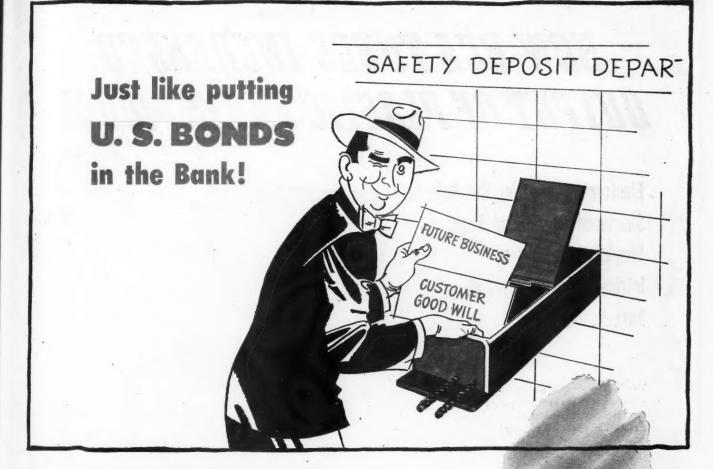
"Sometime ago I installed some ceiling kitchen fixtures with 200 watt lamps in them. Now when the lamps burn out I cannot get the lamps out of the sockets without twisting the lamps out of their bases or twisting the sockets to pieces. The fixtures were 'approved' fixtures and installed in accordance with the Code. What is the matter?"-C.E.

Evidently the lamp holders were not "nickled" or "silvered". The Code does not require such treatment for lamp holders, but usage

Lamps of the size mentioned, and often the smaller ones, also, frequently freeze in their sockets unless the lamp base or the inside of the lamp holders have been nickle plated. Experience has taught this.

If proper fuses have been used they simply "blow" when the lamp leads or the lamp holder insides short, and new sockets have to be installed when lamps burn out.-F.N.M.S.

Electrical Contracting, January 1946



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When selling gets tougher, you'll be glad you had the foresight to specialize on Fluorescent Fixtures equipped with Certified Ballasts. Because of their longer span of top performance and reduced service troubles, they build the kind of customer satisfaction that brings repeat business when it counts most. That's the reason why, as soon as they are available, you'll want to equip all your fixtures with Certified Ballasts.

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GENERAL ELECTRIC CO. Specialty Transformer Section 1635 Broadway, Fort Wayne, Ind. JEFFERSON ELECTRIC CO. Bellwood, Illinois

SOLA ELECTRIC CO. 2525 Clybourn Ave., Chicago 14, Illinois

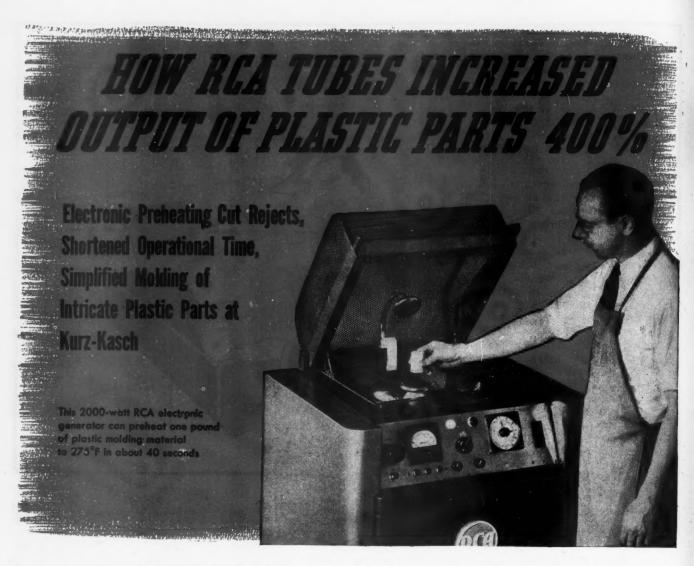
WHEELER INSULATED WIRE CO. 378 Washington Ave., Bridgeport, Conn.



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IN July 1943, Kurz-Kasch, Dayton, Ohio, plastics molder, was called upon to deliver a large quantity of high-priority molded pieces within a few weeks. Because the pieces were difficult to mold, rejects due to poor preheating ran as high as 65%; production of the required quantity seemed impossible to achieve in the time available.

Electronic Preheating Tried: Tests were made with electronic preheating, and the method proved successful. In actual practice, electronic preheating cut overall operational time by 50%. Thus, disregarding rejects, production would have been doubled. But, the reduction in rejects brought the total usable output to 5 times its former level—a 400% increase!

Job Details: The material used in this molding job was Melmac No. 592. The preforms weighed 370 grams, measured 4 inches across and $1\frac{1}{2}$ inches in thickness. A large number of metal inserts were included. Electronic preheating time was only 45 to 50 seconds.

How Electronic Heating Works: By means of RCA electron tubes, 60-cycle commercial power is changed to power at a frequency of several million cycles per second. When this power is passed through the preform it generates heat within the preform.

Advantages of Electronic Preheating of Plastics: Heat is instantaneous and uniform throughout the preform pellet. When the power is shut off, heating stops immediately; there is no residual heat to coast temperatures beyond desired limits. With thermo-

setting plastics, which set with the application of high temperatures, the quick heating possible with electronic heat permits greater workability and results in fewer rejects. Production-line techniques can be employed, cutting processing time to a few minutes—or even seconds.

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Working conditions are improved because no excess heat is dissipated into the work area; there are no gases or vapors to contend with. Electronic heating is noiseless, vibrationless, requires no special foundation or installation expense, and takes little floor space. Electronic-heating equipment is also a high-power-factor (90%) load on the plant electric system.

Turn to Electronics for Solution of Your Own Problems: For information on the electronic-heating equipment used in this application, write to Radio Corporation of America, Electronic Apparatus Section, Camden, N. J.

Electron tubes are providing a practical solution to hundreds of diversified manufacturing problems—process control, machine control, heat-treating of metals, plant protection, and a host of others. Consult with RCA tube-application engineers for information or advice on the application of electron tubes in your own plant. For examples of electronics at work in industry, send for a copy of the free booklet, "16 Examples of Electron Tubes at Work In Industry." Write to RCA, Commercial Engineering Department, Section I-8A, Harrison, N. J.

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TUBE DIVISION

RADIO CORPORATION of AMERICA
HARRISON, N. J.

Electrical Contracting, January 1946

ELECTRONICS

The Maintenance and Servicing of Sealed-Ignitron Rectifiers—Part V

Failure of Tubes to Conduct Properly

The actual detection of tubes which are failing to conduct properly usually comes during regular inspection of the rectifier. Telltale indications of improper conduction, such as noise in the transformer, absence of tube glow, unequal anode, seal temperatures of the various tubes, etc. have been covered in Parts II, III and IV of this series of articles. Also previously mentioned was how final confirmation of this type of trouble could be obtained by means of hook-on ammeter readings. The oscilloscope may also be used to detect which tube is not conducting when trouble of that sort is suspected. Therefore, it remains for this article only to analyze the causes of and indicate the correction for improper tube conduction.

There are three different categories of failure to conduct: (1) complete failure of the tube to carry current, (2) partial failure resulting from ignitor misfire, and (3) steady unbalance of current between the various tubes.

Complete Failure to Conduct

Very infrequently a tube will be found which is completely dead, i.e., it carries zero current when all the other tubes in the rectifier are loaded. Causes for this condition usually may be traced to one of the following:

Broken or Loose Ignitors—The ignitor points are attached to steel supporting rods. Sometimes the mercury in the tube is splashed against the ignitor, because of carelessness in handling the tube. This may cause the ignitor point to break off or come loose at the point it is supported. If resistance or bell ringer tests show that the ignitor circuit is completely open inside the tube, it

L. W. Morton
Industrial Engineering Division
General Electric Company
Schenectady, New York

may be assumed that the type of fault described above exists.

Ordinarily the spare ignitor is mechanically intact in such a tube and the connection to the ignitor can be transferred from the faulty ignitor to the sound one. The fact that the broken ignitor point is floating on the mercury, will not usually cause any difficulty.

Ignitors Burned Off—Ignitors may also be burned off by reverse current through the ignitor. Reverse current may flow if the dry plate rectifier or electronic tube in series with the ignitor (in the firing equipment) is defective. Sometimes wrong electrical connections

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TIME DELAY FELAY COIL

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FIG. 4—Elementary diagrams of two often used circuits for detection of misfire in rectifiers.

are made and an a-c voltage is connected to the ignitor by mistake. In any event, tests should be made to determine whether the possibility of reverse current exists, whenever an open ignitor is found. Sometimes reverse current does not completely burn off the ignitor. Instead it damages it and causes hand firing

Trouble in the Firing Circuit—Failure of wiring or firing circuit components may cause one or more tubes to completely fail to conduct. The tests to determine the cause of such firing circuit trouble are covered later in this article under "Ignitor Misfire."

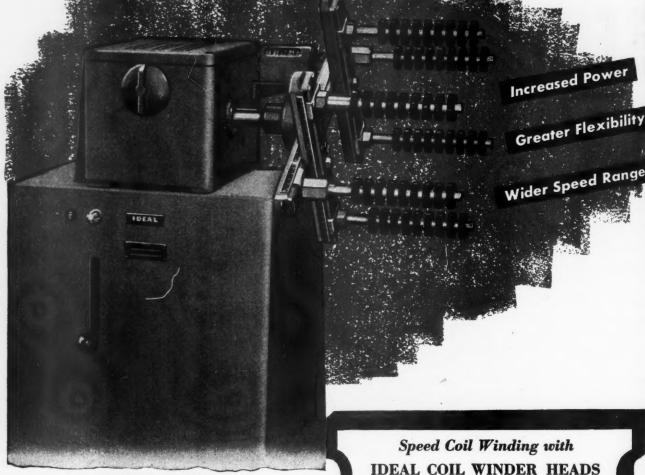
Tube Filled with Air—If a tube fills completely with air it will not conduct. The tests for leaky tubes described previously may be employed. When a tube has air in it, current will flow through the ignitor but the ignitor will not fire. This condition can be tested by observing the voltage by means of oscilloscope between holding anode terminal and cathode of the tube while the rectifier is carrying the load. If there is much air in the tube the holding anode fails to conduct.

Open Circuit in Rectifier Transformer—If no other reason can be found for complete failure to conduct, the main rectifier transformer should be tested to see if the secondary winding associated with the faulty tube has an open circuit.

Ignitor Misfire

Ignitor misfire is characterized by intermittent failure of a tube to carry current. Nearly all ignitron rectifiers occasionally misfire. There is greater tendency to misfire when the ignitors are cold. For most applications this is not objectionable as its only effect is to

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For winding or good-as-new re-winding of a wide variety of types and sizes of coils. Constant wire tension is automatically maintained, thus assuring uniformly-wound and perfect coils.

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IDEAL "Universal" Model Winds perfect coils in sizes ranging from 3½" x 6½" up to 13" x 16½". Wound from



IDEAL
"Concentric" Model For winding field coils of single phase motors. Coils may be wound

1302

Complete Line Of Coil Winder Heads To Meet All Needs PROMPT DELIVERY

cause a slight reduction in the output voltage for a single cycle.

Ignitor Missire Detection System

Sealed ignitron rectifiers are usually supplied with misfire detection equipment. Fig. 4 shows the elementary diagrams of two circuits often employed. Fig. 4A is used with 6-phase, double. wye transformers. When misfire occurs a sub-harmonic voltage (one-third of normal interphase frequency) appears across the interphase transformer. The reactor, capacitor, and coil of a time delay induction relay are turned to resonance at this abnormal frequency, so that misfire causes the relay to start closing its contacts. If the misfire persists for a definite time (approximately 10 seconds) the relay contacts close and light a signal or ring an alarm.

The Fig. 4B circuit is used with 12 tube combinations where two tubes normally conduct simultaneously. In such circuits, when one tube fails to conduct its companion tries to carry the load of both tubes, and therefore no sub-harmonic appears in the interphase transformer. Small current transformers, with their secondaries in series, are so connected that when all tubes conduct properly the current transformer secondary voltages cancel each other. If one tube fails to conduct, a definite voltage appears which operates the relays and signals or alarm.

Both schemes are based on the principle that a small amount of misfire is acceptable, hence the time delay relay to give alarm, only, when persistent misfire exists.

Wet Ignitors

1302

One of the most common causes of ignitor misfire is ignitor wetting. A good ignitor should not become wet by the mercury in which it is immersed. However, when impurities such as gold, silver, copper, nickel, and iron, inadvertently get into the mercury, they tend to cling to the ignitor and coat it. If the boron carbide of the ignitor becomes coated, mercury will tend to wet the surface instead of being repelled.

A wet ignitor requires increased firing power for successful ignition, depending on the area of the patch on the ignitor which has become wet. Depth of immersion of the ignitor varies during normal operation because of the ripples on the mercury pool surface. This condition creates a statistical likelihood of the mercury covering or uncovering patches of an ignitor which will wet, and thus causes ignitor misfire which has an intermittent characteristic.

The best way to find out if an ignitor is wet is to remove the tube from the rectifier and connect an ohm analyzer between ignitor and cathode. If the ignitor is wet a place is found where the resistance does not change when the mercury is raised and lowered as the tube is tilted at various angles. If it misfires in some positions but not in others, the conclusions can be drawn that wetting is present.

The spare ignitor may be tried after a wet ignitor is discovered; but usually good operation will not continue long on the second ignitor as the primary cause of wetting usually will tend to effect both ignitors.

High Resistance Ignitors

Sometimes ignitor resistance characteristics gradually become so high that misfire results. Such misfire shows up in the oscillograph observations as characteristic tendency toward late fir-

Faulty Ignitor Firing Circuit

It is seldom that trouble develops in the magnetic type of firing circuits usually supplied with sealed ignitron recti-However, the following is a description of the normal behavior of a typical magnetic ignitor firing circuit, to fully prepare the maintenance man for all eventualities.

Principle of Operation

It will be noted that the three singlephase firing circuits, Fig. 5A, can be each divided into five functional portions as follows:

1. Holding anode excitation (obtained from the "Y" secondary windings) of the control power supply transformers.

2. Dry plate rectifiers (DPR) which rectify the current flowing to the ignitor.

3. Peaked voltage wave shape generating circuits comprised of components AUT, FL, FC and LL.

4. Angle of phase control for adjusting output d-c voltage consisting of d-c saturable reactor PL, linear reactor CL, and capacitor PC.

5. Control power transformer HT with phase shifting windings ET for phasing the ignitors in approximately the correct vector position with respect to the anodes.

Each single-phase firing circuit fires two ignitors at 180 electrical degree intervals. (For instance, the ignitors in tubes 1 and 4 are fired at 180-degree intervals each cycle.) In order to follow the principles of operation, assume a positive half wave voltage at the X6 terminal of winding ET3. This positive voltage appears across reactors PL, LL, and at terminal 2 of FL and terminal 1 of FC. The capacitor starts to charge in the positive direction at the No. 1 terminal side. Self-saturating reactor FL presents an impedance which at first allows only a trickle of current to flow through the dry plate rectifier to the ignitor. However, as the positive voltage increases and the capacitor charges, the iron in reactor FL suddenly saturates and its impedance decreases to a low value. Capacitor FC quickly discharges its stored energy through FL, DPR, and the ignitor, causing the ignitor in tube No. 1 to fire. The proportions of the circuit are so designed that the energy stored in the capacitor will be discharged in a short time, approximately 15 to 20 electrical degrees, which gives rise to the short duration impulses shown in Fig. 5B, EIG. One hundred and eighty electrical degrees later, the ignitor in tube No. 4 is fired in a similar

Fig. 5B shows that the timing of peaked wave impulses EIG can be adjusted over a 42-degree electrical range by adjusting the saturating current from zero to 1½ amperes. Increasing the d-c saturating current, advances the instant of firing in time phase with respect to the main anode voltage. This phase shift is brought about by adjusting the d-c saturating current and consequently the reactance of PL which is the variable element of the reactance, capacitancetype phase shifting bridge circuit consisting of PL, CL and PC.

Normal Behavior of Firing Circuits

Figs. 5C and 5D are tabulated data applying to the typical ignitor firing circuit shown in Fig. 5A. In case of firing circuit trouble, oscillograph and instrument tests may be made, and the data obtained compared with the information shown in Fig. 5. From the comparison it should be possible to determine quickly the location of the trouble. When the rectifier, for which the maintainer happens to be responsible, has a different firing circuit than the one illustrated, it is advisable for the maintainer to make similar records to establish the normal behavior of his rectifier. Then if he ever has any trouble, he will be prepared.

If trouble occurs in such components as reactors, capacitors, or control power transformers, the defective part should be replaced with a new one as quickly as possible. If it develops in the dry plate rectifier, and the d-c ohmmeter test described in Part III of this article cannot be used, then it may be necessary to make a current test to establish the degree and exact point of failure. One way to make a current test is to insert an oscillograph shunt in series with the dry plate rectifier and observe the wave shape of the current through the rectifier. A defective dry plate rectifier will allow substantial current to flow during both positive and negative, half waves. A good dry plate rectifier will not allow discernible negative current



Ignitor Firing Requirements

Ignitors may be classified into three categories, depending upon the volts and amperes required to cause them to fire. These are "easy firing ignitors", "hard firing ignitors", and ignitors which "misfire". It is necessary to watch the screen of the oscillograph, observing ignitor voltage for periods up to one minute or more, to classify the ignitors. An easy firing ignitor should not require more than 75 volts peak to fire. A hard firing ignitor requires 75 to 250 volts to fire. Ignitors which misfire usually draw more current than normal ignitors, and as the regulation of the firing system is appreciable, the voltage observed when an ignitor misfires can be anything from 15 to 400 or 500 volts.

Sometimes it may be desirable to determine minimum volt-amperes required to successfully fire a given ignitor (Fig. 6). Before making the tests the 0-to-100 ohm resistor shown in Fig. 6 should be calibrated so that the resistance of each of the buttons is known. Starting with the resistor on the zero end, it should be increased gradually until the ignitor being tested starts to misfire. Then make the following measurements:

1. Measure the voltage from ignitor terminal to cathode.

2. Connect the oscillograph to observe and measure the voltage across the portion of the resistor through which the current to the ignitor is passing. (The voltage under misfiring conditions should be measured.)

3. Measure the total voltage across the resistor and ignitor. (The sum of the two voltages measured under Item 1 and 2 should be equal to this last measurement, serving as a check on the accuracy of the tests.)

4. Divide the voltage measured across the resistance by the calibrated value of the resistor at its setting. This result gives the ignitor firing current.

5. Item No. 1 is the voltage required and Item No. 4 is the current required, and from these two figures the voltampere characteristics of the ignitor are known. (The voltage should not exceed 300 and the current 40, for acceptable ignitors.)

Unbalanced Tube Currents

The existence of a current unbalance between tubes is rarely detected except by means of the hook-on-ammeter. The effect of unequal current between various tubes is to overload some of the tubes, thereby producing a tendency toward arc-back or shorter tube life.

The most usual cause of tube current unbalance is unequal arc-drop in the various tubes in the rectifier. The arc-drop voltage is that voltage existing between the main anode and cathode during the conducting period.

There are two things which can effect-

the normal arc drop of a tube: namely, tube temperature, or presence of foreign gases in the tube. In general the higher the temperature of the tube, the lower will be its arc drop. Hence it will tend to carry more current than other cooler tubes in the rectifier. When a tube has high arc drop voltage because it is leaky, it should be replaced at the earliest opportunity. Tests for leaky tubes have been fully detailed earlier in this article. If in the event of unbalanced tube currents the maintainer is unable to correct the trouble by giving attention to the above factors, he should call in the manufacturer's field engineering representative.

The degree of current unbalance which is unacceptable will vary, depending on the application and whether or not the rating of the power rectifier equipment utilizes the full ability of the tubes. However, plus or minus 10 percent unbalance between the tubes is usually acceptable, but attention should be given to those cases where it exceeds 10 to 15 percent.

Operation with Less Than the Normal Tube Complement

Sealed-ignitron rectifiers may be kept in service when one or more tubes are disconnected, or for other reasons are carrying no current. This fact is an advantage which is often made use of in maintaining service to some important

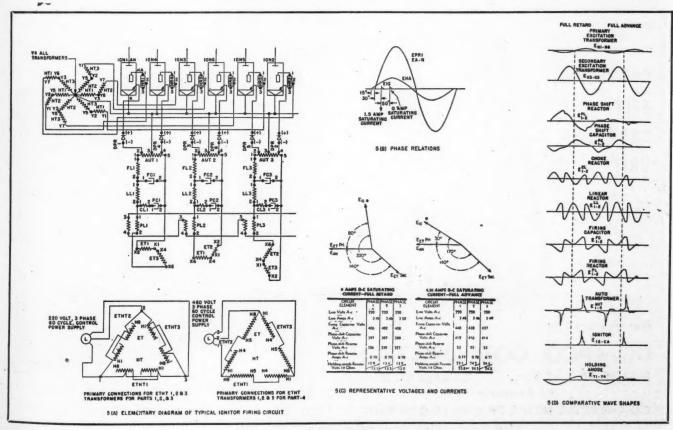


FIG. 5-Typical ignitor firing circuit, voltages, currents and wave shapes.



process or operation until it is convenient for other reasons to shut down the rectifier and replace a faulty tube.

It is, however, bad practice to operate the rectifier for extended periods of time and under all conditions of load without the full, normal complement of tubes. Without the normal tube complement there will be unbalanced current in both the transformers' secondary windings and in the tubes themselves. While in general this does not cause excessive transformer heating, critical results may occur in the remaining tubes which are called upon to carry the whole rectifier load. In most of the rectifier circuits, when one tube is disconnected one of the remaining tubes may be called upon to carry nearly twice as much peak current as it would otherwise be carrying if all the tubes in the circuit were carrying their share.

If it is necessary to operate continuously a rectifier with a six-phase, doublewye transformer with one tube disconnected, the maximum continuous load should be reduced to approximately 60 percent of rated current. This is a good rule to follow, as a matter of fact, for most sealed ignitron rectifier circuits. When a tube reaches the end of its life for any reason whatsoever, the only safe step is to replace it and continue operation with the normal complement

just as soon as possible.

Unplanned Service Interruptions

The maintainer is always faced with the remote possibility of an unplanned interruption of power. He must be prepared to locate trouble quickly and repair it so that the apparatus may be immediately returned to service. Sealedignitron rectifiers, in common with other electrical apparatus, are provided with switchgear and control designed to automatically protect the rectifier equipment and the systems to which it is connected from abnormal operating conditions. It is not unnatural that a feeling of bewilderment should come over the maintenance man when he is suddenly faced with an emergency, such as an unplanned service interruption. However, by recognizing the fact that what has happened is normal, because the control is designed to take the equipment out of service automatically in cases of trouble, he can quickly eliminate the psychological strain of the emergency. The control, by junctioning in accordance with its designed purpose, is valuable insurance against serious equipment damage.

The control for sealed ignitron rectifiers is nearly always designed to offer protection against the following abnormal conditions, in the manner indicated:

Abnormal Conditions

D-C short-circuit current and overload.

Arc-Back.

Main transformer over-tem-

- Loss of water flow. Loss of water pressure.
- Water over-temperature.

Ignitor misfire and failure of tube to conduct current.

Number of the device if fully Protection Provided by Means of automatic D-C breaker with instantaneous and time delay over-current trip. D-C air circuit breaker reverse and 72 & 52 over-current trip.

A-C power circuit breaker inverse time and instantaneous over-current trip. 49 Contact making thermometer, or winding temperature detector circuit and Water flow relay. 88 W Water pressure relay. Thermostatic relay.
Misfire detection circuit, relay, and 46

* Note — When the rectifier is fully automatic, it is usually equipped with an automatic recloser which returns the complete rectifier back to service after an arc-back. If, however, three successive arc-backs occur within a given interval (usually three minutes) this automatic reclosing device can be adjusted to lock the rectifier out of service. When such a device is available the lock out relay number is 86.

alarm or signal light.

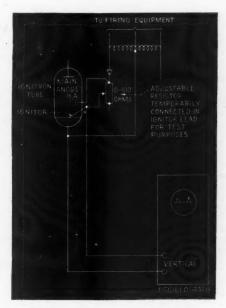


Fig. 6-Testing ignitor firing.

When the maintenance man knows what abnormal conditions the equipment is automatically protected against, it is a simple matter for him to inspect the various relays to see which one caused

any given interruption. As an illustration, suppose that a rectifier has disconnected itself from the system because of failure in the motor winding of a water circulating pump. The maintenance man arriving at the rectifier will find that either the d-c breaker, or both the a-c and d-c breakers, are open, depending on the type and design of the rectifier. When he tries to reclose them and place the unit back in service, he finds he cannot. It follows, then, that some one of the protective relays is indicating an abnormal condition. Hasty examination of the three or four protective relays should show that the water pressure relay indicates loss of water pressure. There are two possible causes: loss of water from the cooling

system, or a failure of the water circulating pump. Obviously, because the water circulating pump is very accessible, it should be inspected first and the maintainer will find that the pump isn't turning over. The next obvious point to inspect will be the thermal overload protective devices for the motor, which will, in case of motor burn-out, have tripped the motor control circuit.

Effect of Reverse D-C Power

When it is known that it is possible to have regeneration of power that cannot be re-absorbed by the d-c system, the user usually buys a dynamic braking protective panel with the rectifier. ·This protective panel consists of a load absorption resistor, contactor, and volt-

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"Industrial Electronic Control," by W. D. Cockrell. Published by McGraw-Hill,

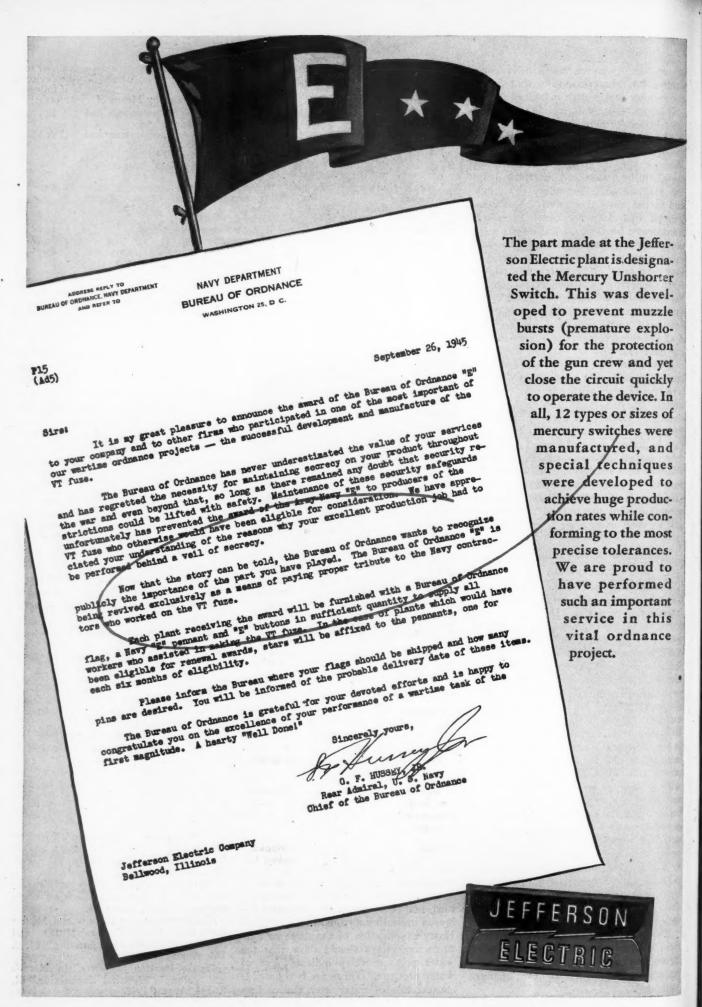
"Mercury Arc Power Rectifiers," by Marti and Winograd, Published by Mc-Graw-Hill, N. Y.

"Voltage and Wave Shapes of Mercury Arc Rectifiers," by H. D. Brown and J. J. Smith—AIEE Transactions 1933, Vol.

52, Pages 973-984.
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"Ignitor Excitation Circuits and Misfire Indication Circuits," by Mittag and Schmidt," "Electrical Engineering," 61, 8, 574, August 1942.

"Sealed-Ignitron Rectifiers," by Morack and Steiner," "Electrical Engineering," 61, 8, 594, August 1942.



age sensitive relay. When conditions of regeneration are present, the d.c voltage of the system increases above the nominal voltage level of the d-c system; and the over-voltage relay automatically closes the contactor and applies the resistor to the system.

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caused by regeneration may reach proportions high enough to cause the rectifier to arc-back. Another source of excess d-c voltage can arise from lifting magnets when they are de-energized. Surges as high as two or three thousand

The magnitude of the d-c over-voltage have been measured on 250-volt systems which were caused by lifting magnets. In cases of surges of this sort it is necessary to connect a non-linear type resistor, such as Thyrite, across the direct current system to absorb and prevent the surge.

TROUBLE CHART

The following trouble chart tabulates in condensed form suggestions from this article for use of the maintenance man:

TROUBLE	POSSIBLE CAUSES	Tests and How to Determine the Cause and Location of the Trouble and Other Suggestions.	REMEDY
Arc-back Interruptions.	1. Leaky tubes.	 Color test. Click test. Bubble test. Inspection for cracks. High frequency spark coil. 	Replace faulty tube.
	2. High mercury vapor pressure.	 High potential test. Overload on one or more tubes because of tube current unbalance. Overload on complete rectifier. Improper operating temperature (Either 	Correct the condition producing high tube temperature.
	3. Dirt inside tube.	too high or too low.) 10. Reached the end of tube life. 11. Excess load and phase control.	Replace faulty tube. Adjust transformer taps for
	4. Excess phase control.	12. Discoloration on inside of glass anode seal.	minimum phase control.
	Miscellaneous (meaning any of above causes).	13. Trial and error tube replacement.14. Magnetic links and surge crest ammeters.	Replace faulty tube.
Failure of Tube to conduct properly.	Complete failures: 1. Broken or loose ignitors.		Change ignitor, replace faulty tube, repair transformer or firing
	 Ignitor burned off. Tube filled with air. Open Transformer Winding. Trouble in firing circuit. 	15. Hook-on-ammeter.16. One tube has no arc glow.17. One tube is perceptibly cooler than the others.	circuit. Note: Operation permissible at approximately 60 percent of rated rectifier load with one
	Misfire:		tube out of service.
	 Wet ignitor. High resistance ignitor. Faulty ignitor firing circuit. 	 Noise in transformer. Misfire relay operation. Oscillograph test of ignitor volts. Compare instrument readings and oscillograph tests of firing circuit with similar data showing normal behavior. 	Change ignitor or replace faulty tube.
	4. Excessive ignitor firing requirements.	22. Make firing requirement test.	
	Unbalanced tube currents: 1. High tube arc drop voltage. 2. Unequal tube temperature. 3. Gassy tube.	15. Hook-on-ammeter.23. Test anode to cathode arc volts by oscillograph.	Replace faulty tube or correct condition causing unequal tube temperatures.
D-C over-voltage or surges.	D-C motors such as used for cranes, ore bridges, etc. on d-c system regenerating d-c power. Lifting magnets cause surges.	24. Recording d-c volt-meters and ammeters on d-c system.	Dynamic braking protective panel, resistor, or Thyrite should be connected across d-c system.
Unplanned service inter- ruption.	 D-C short circuit overload. Arc back. 	Main d-c breaker has tripped. Both a-c and d-c breakers have tripped and lockout relay operated.	
	3. Overtemperature in main transformer.	Transformer thermometer reading, or winding temperature detector relay operated.	
	4. Loss of water flow.	Water discharge has stopped and water flow relay operated.	Hunt for location of trouble and correct condition causing it.
	5. Low water pressure.	Water pump stopped or water pressure relay operated.	
	6. Water overtemperature. 7. Ignitor misfire.	Thermostatic relay operated. Noisy transformer. Misfire relay operated alarm, light, or bell.	

NATIONAL

PABC Cable

NATIONAL ELECTRIC PRODUCTS WIRKS OSSIES CABLES

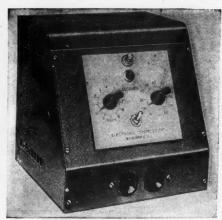
National Electric

THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed description, sizes, prices and other data write to the manufacturers' advertising departments, tell them in what issue of ELECTRICAL CONTRACTING you saw the item and they will send full details to you.

EQUIPMENT NEWS

Electronic Interval Timer

A sloped-front 8 by 8 by 8 in. cabinet houses this electronic interval timer supplied for 115 volt a-c operation and equipped with a 2050 thyratron tube. Two dials permit time selection from 1 to 120 seconds; one dial being calibrated in 10

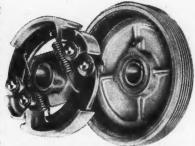


ELECTRONIC TIMER

second intervals and the other in single seconds. A double receptacle permits two circuits being timed simultaneously with a claimed accuracy of five percent. Electronic Controls, Inc., 44 Summer Ave., Newark 4, N. J.

Automatic Clutch

To eliminate the shock of starting machinery or moving equipment, an automatic clutch has been developed. It can be installed on the shaft of any engine or electric motor and operates on the principle of centrifugal action, progressively a pplying power to the driven ma-

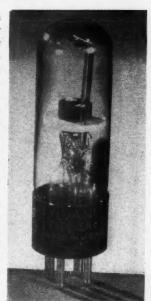


SALSBURY AUTOMATIC CLUTCH

chine. It offers complete disengagement while idling and positive non-slip engagement while driving. Uses include the driveshaft-powering of fans, air compressors, lathes, grinders, hoists and pumps. The centrifugal clutch is an opposed shoe type, dual spring balanced to furnish the desired tension so that the clutch idles below a predetermined shaft rpm. and, with an increase in shaft speed, the expansion shoes press outwardly to contact the friction lining of the drum and transmit the desired power. Two models are available; one for ranges up to 3 hp. and the other to six. A choice of shaft drives includes V-belt, flat belt pulley, gears, sprockets, couplings and varied speed transmissions. Salsbury Motors, Inc., 4464 District Boulevard, Los Angeles 11, California.

Stroboscopic Light Source

Cold cathode electron tubes with two internal trigger grids for operation in simple condenser discharge circuits are now avail-Their use permits the visual stopping, slowing or reversing of rotating or reciprocating motion and allows continuous inspection, timing or stressstudy of fan blades, cams, gears and other cycle-repeating mechanisms. Frequency of flashing may be controlled and calibrated over wide limits to produce a compact direct reading instrument. High peak current makes these tubes particularly adaptable to relay and control applications. Fully enclosed and without moving parts they provide positive relay action in many applications. Standard strobotrons measure 432 in. overall including T-9



SYLVANIA TUBE

bulb and 4-pin base and have a diameter of 1½ in. Instantaneous surges of 5 amperes are permitted with 50 milliamperes average current with 350 volts d-c on the anode. Sylvania Electric Products Inc., Salem, Mass.

Silicone Greases

Two new Silicone greases, compounded with metallic soaps, are now available to lubricate bearings operating at abnormally high and low temperatures and at speeds up to 10,000 rpm. Characterized by a high order of heat stability, low volatility, relatively slight changes in consistency over a wide temperature range, resistance to water and low freezing points; these greases are suggested for permanently lubricated bearings, for the lubrication of oven machinery and pumps handling hot salts. Extensive tests have demonstrated their acceptability through temperature ranges of -70 to 150°C (-94 to 300°F) for the new DC 33 lubricant and of -20 to 175°C (-4 to 347°F) for the new DC 44. Two other greases (DC 31 and DC 41), introduced last year and since improved, are compounded of inorganic materials, contain no graphite, possess exceptional thermal stability and are semi-conducting due to finely divided carbon black used as a thickening agent. DC 31 and DC 41 are recommended for speeds below 4000 rpm. Dow Corning Corporation, P. O. Box 592, Midland, Mich.

SPECIAL PURPOSE OUTLETS

DISTRIBUTED THROUGH ELECTRICAL WHOLESALERS
HART & HEGEMAN DIVISION

THESE Outlets serve special purposes in addition to those served by ordinary receptacle types. Their extra-utility has durable basis in right design, rugged parts, reliable workmanship.

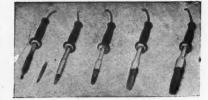
No. 7707,—Clock Hanger Outlet: Provides electrical connection and mechanical support for clock. No. 7792,—Weather-proof Receptacle with cadmium-finished brass plate, metal cap and weather-tight rubber mat. No. 7797,—Floor Outlet, with 2 threaded brass covers; one to shield plug cap and one to close outlet when not in use. No. 7750,—Fan Hanger Outlet: Provides mechanical support for fan, with electrical connection. No. 1914, — Duplex 2-circuit Receptacle; one circuit always "ON" for appliances, the other to be switch-controlled as for lamp circuit.

Ask for complete catalog listings of the types here shown as representative, as well as standard outlets and switches.

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U. S. A.

Soldering Irons

A new line of industrial soldering irons range from 75 to 300 watts in size with tips varying in diameter from $\frac{3}{8}$ to $1\frac{1}{4}$ inches. Quick recovery and heat reserve capacity permit continuous work under severe



G. E. SOLDERING

conditions. Calrod heating elements and surface-alloyed parts subjected to high temperatures permit longer life and simple maintenance. Irons are well balanced, of sturdy construction and have plastic handles to promote coolness and ease of gripping. General Electric Co., Schenectady, N. Y.

Variable Rectifier Equipment

Three models of selenium rectifiers, designed for 115 volt a-c, single phase, 60 cycle power, are available for electroplating and general laboratory use. Model D190A operates at 25 amp., 6 volt and is convection cooled. Models D191A (37/75 amp.) and D207A (75/150 amp.) operate at 12/6 volts and are fan cooled. Wall or bench mounted, the units may be



RICHARDSON-ALLEN RECTIFIER

combined to increase power ratings. Also featured is a single control to vary the output from zero to full load, overload protection and output voltmeter and ammeter. In the d-c field where selenium rectifiers are less applicable, high vacuum, mercury vapor or inert gas type vacuum tubes are utilized. Richardson-Allen Corp., 15 W. 20th St., New York 11, N. Y.

Centering Head

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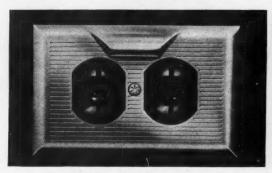
The Boyce centering head combines the functions of the protractor, centerhead, center punch, level and scale. The body is made of cast aluminum while the protractor is sheet aluminum with 2½ deg. graduations and 10 deg. markings for quick reading. The dial is fitted with a level; the centering punch is of § in. hardened steel. It can be used to measure or establish the degree of any angle or bend on the outside or inside of any circumference; also toBOYCE CENTERING HEAD measure the declivity of any flat surface; or, with the aid



of a straight edge, to mark or measure an angle of any degree on a vertical surface. To measure the degree of an angle or bend the dial is set at the desired degree and the tool is placed on top of the pipe or conduit just above the bend location so that, as the bend is made, the leveling guage can be immediately read in terms of the bend in degrees. Eastern Research and Engineering Co., 37-39 Pearl St., Boston 10, Mass.

Luminite Outlet Plate

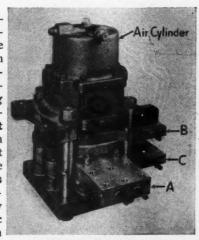
Luminous toggle switches and matching LumiNite Convenience outlet plates are now available. These plates of molded ivory plastic contain an integral housing for the tiny neon light mechanism which it is claimed operates at less than two cents a year. Connected across switch terminals the light glows when the switch is in off position or convenience outlet plate light glows continually. The Plascon plates are non-conducting; rust, tarnish and corrosion proof; washable and easily installed. Multiple switches may be combined on a single plate. Associated Projects Co., Columbus, Ohio.



ASSOCIATED OUTLET PLATE

Contactor-Controller for **Battery Activated Welding**

This contactor-controller operates on the theory of the carbon pile rheostat. The carbon pile contactor is a rugged, heavy duty assembly capable of making and breaking heavy currents continuously. It consists of three carbon discs assembled so that the surface areas are only a few thousandths of an inch apart. Compression is obtained by means of an electric solenoid valve which operates a piston exert-



PROGRESSIVE CONTROLLER

ing pressure on the carbons with a corresponding decrease of resistance to the flow of current. Interruption of current is accomplished by releasing the air pressure and allowing a spring assembly to separate the plates. Capacity of the unit is doubled since the current takes two simultaneous paths through both the top and bottom discs to the middle doublefaced plate. Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich.

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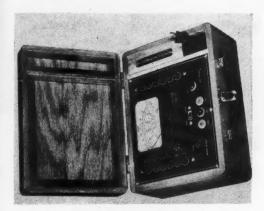
INSULATION & WIRES
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TRI-STATE SUPPLY CORPORATION

Manufactured by THE P. D. GEORGE COMPANY, ST. LOUIS, U. S. A.

Multiple-Purpose Testing Meter

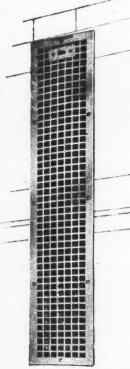
A new heavy-duty, multiple-purpose, Model PB 200 Speed-O-Meter has been announced. This oak-cased, portable unit measures both a-c and d-c voltages, d-c current, capacity, decibels and resistance. Pushbutton action selects both service and range. A sensitivity of 2000 ohms per volt is claimed on both a-c and d-c while large calibrations, printed directly on the meter scale, afford good readability. Superior Instruments Co., Dept. W., 227 Fulton St., New York 7, N. Y.



SUPERIOR METER



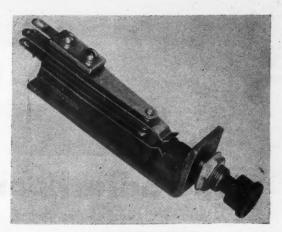
This new bathroom heater designated as the Head-to-Heel model, provides almost instantaneous warmth to either augment a central heating system or to establish temperaturecomfort in an otherwise unheated dwelling. The chromium-finished steel grille measures 9 in. by 48 in. by 1 in and the wall box $7\frac{1}{8}$ in. by $46\frac{1}{8}$ in. by 4 in. Constructed without a vent or flue, the space requirements are kept at a minimum. All heaters are equipped with a switch on the grille; a double pole on the 230 volt heaters and a single pole on the 115 volt units. It is listed by Under-writers' Laboratories, Inc. Thermador Electrical Manufacturing Co., 5119 S. Riverside Drive, Los Angeles 22, Cal.



THERMADOR HEATER

Push and Plug Jack Switches

Standard and heavy duty push and jack switches of 5 and 10 ampere capacity have been designed for circuits exceeding the normal current carried in communications and signal systems. Series 5300 and 5300X are nickle-plated, have silver-contact phosphor-bronze springs and have rubber



MOSSMAN SWITCH

plungers with plastic knobs. The measurements are $\frac{3}{4}$ by 1 by $4\frac{1}{4}$ in. These switches also may be used in the same applications as 4300 and 4400 for test panels, instruments and meter circuits. Donald P. Mossman, Inc., 612 N. Michigan Ave., Chicago 11, Ill.

Lag Fuse Links

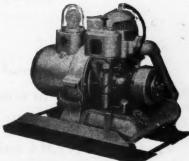
A renewable fuse link has been engineered to locate lag in conformity with the current curve traced by all types of every-day overload. According to the manufacturer the design is such that more of the lag is obtained in the lower brackets of the fuse overload than formerly. The result of such "balancing" is to increase the lag in the current areas most frequently reached in the normal operation of equipment without altering the safety factor of the link at the higher current levels produced by shorts, grounds and other electrical trouble. Links are available in all sizes from 0 to 600 amperes and from 250 to 600 volts. Pierce Renewable Fuses, Inc., 211–219 Hertel Ave., Buffalo 7, N. Y.



PIERCE FUSE LINK

Lightweight Generators

Two new gasoline engine-driven generators are announced as portable power sources for electric tools, floodlights, radio, amplifying or motion picture equipment. New design incorporates large aluminumalloy castings to permit increased output while maintaining



HOMELITE GENERATORS

portable weight limits; a single self-seating, rotary disk type valve, an improved Wico magneto for starting and an automatic built-in speed governor. All moving parts are sprayed by a pressure-vapor oil system. Homelite Corp., Port Chester, N. Y.



- ... Excellent electrical properties
- ... Thin coating-smaller OD
- ... Non-inflammable self-extinguishing
- ... Ease of installation
- ... Good resistance to heat and cold
- ... Light weight
- ... Extreme age and ozone resistance
- ... Resistance to oils, acids, chemicals
- ... Ultra-high flexlife
- ... Entire NEMA color range
- ... SAFETY assured by Underwriters tests

The next time you order wire or cable from your supplier be sure to specify-

Wire insulated with GEON Wire carrying Underwriters approval

For additional information please write Dept. Y-1, B. F. Goodrich Chemical Company, 324 Rose Bldg., Cleveland 15, Ohio.



B. F. Goodrich Chemical Company THE B. F. GOODRICH COMPANY

Aluminum Wall Plate for Service Entrance Cable

A new streamlined aluminum wall plate for service entrance cable up to three No. 4 wires is now available. Hole in base of plate serves as either drip or ground. Furnished with the plate are two wood screws for mounting or a generous cut of non-drying calking compound for weather-proofing. Thomas and Betts Co., Inc., 30–36 Butler St., Elizabeth 1, N. J.



THOMAS & BETTS PLATE

Small A-C Motor

A new capacitor start induction motor is availble. It measures 4 in. by 4 in. by 5 in. Horsepower is 1/25th to 1/70th. A high starting torque, prompt reversal, quiet operation without radio interference and long life are claimed by the manufacturer of this compact unit recommended for driving fans, blowers, ventilators, switching



SMALL A-C MOTOR

devices, small hand tools, unit heaters and dozens of similar chores. Of standard design, many additional selected characteristics may be incorporated by specification. These alternate possibilities include capacitor, split phase or shaded pole starting: speeds from 1150 to 3350 rpm. with any desired speed reduction gearing; ball or sleeve bearings; corrosion, shock or explosion proof construction with cast iron or aluminum housing and rigid or flexible base, flange or clamp. Small Motors, Inc., 1308 Elston Ave., Chicago 22, Ill.

Resistor Ballast

The Presto unbreakable resistor is for a-c or d-c, 15 or 20 watt fluorescent lamp installations. All steel construction is designed for long life and ruggedness while multiple venting reduces temperatures. Used independently of

46

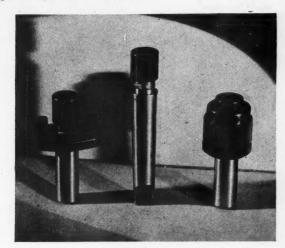


PRESTO BALLAST

other ballast; this black-finished, compact $(1\frac{1}{4}$ in. by $1\frac{7}{8}$ in. by $6\frac{1}{8}$ in.) unit is easily mounted. It is approved by Underwriters Laboratories. Presto Electric Co., Union City, N. J.

Floating Tool Holder

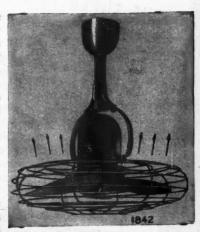
A new small-size floating tool holder embodies a three-jaw power grip. It is for use with screw machines, lathes and drill presses on reaming, drilling and small tapping operations. The rugged chunk holds shank sizes from No. 80 drill to \(\frac{1}{4}\) inch without changes; eliminating the necessity for an assortment of bushings and collets. An improved line includes taper arbor and straight shank chucks, also two types of floating tool holders. A single locknut allows simple, fast adjustment of compact model KFTM which features the new floating tool holder. Kett Tool Co., 5 East 3rd St., Dept. E C, Cincinnati 2, Ohio.



KETT TOOL HOLDER

Heat Circulator

Capitalizing on the known fact that hot air rises to accumulate as wasted heat at ceiling heights, a new fan has been introduced to direct these unused B.t.u.'s upward, outward and downward along wall areas to circulate with the cooler air found at body and floor levels. The RECO Heat Circulator Fan is especially recommended for those hard-to-heat locations where alcoves, deep beams or large, cold



REYNOLDS ELECTRIC CO.

window areas create local problems. Dissipation of smoke and odors as well as the maintenance of uniform temperatures and humidity indicates its use in crowded halls and taverns. Churches and large assembly halls with high ceilings take many hours before the air is warmed from the top downward to body level. Tests have shown that 90° temperatures are common at ceiling height while 60° temperatures at the occupied levels create discomfort. Fan circulation speeds heating by bringing the warm air down to the usable elevation. Obtainable with blades of 12 in., 16 in., 20 in. and 24 in. diameters, it is furnished for 110/115 volt, 60 cycle, a-c motors. Reynolds Electric Co., 2650 W. Congress St., Chicago 12, Ill.



Freddy Firefly presents the SUPER HI-LITE

THE SUPER HI-LITE

- for office, drafting-room, laboratories, schools and institu-
- 48" horizontal type, 4-light unit with louvred bottom and side ceramic coated glass
- for flush-mounting or suspension hanging . . . single or continuous row.
- send for illustrated catalog sheets which include the Super Hi-Lite.



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MOTOR-GENERATOR MAINTENANCE

1 "Modern Motor-Generator Maintenance and Repair Equipment" is 36 page booklet outlining check-up, maintenance and repair. All necessary electrical and mechanical aids presented. Ideal Commutator Dresser Co.

SMALL MOTORS

Three bulletins; 10-A, 10-B and 10-C; give complete description of motors in the 1/200 to 1/20 hp. range. Motors discussed are the shaded pole type for a-c, universal and d-c, and units designed for smooth, quiet operation. Robbins and Myers Co.

SUBSTATION SWITCH MECHANISMS

Publication 4508 describes and diagrammatically shows 9 arrangements for group-controlled sub-station disconnecting switch mechanisms. Delta-Star Electric Co.

INTER-COMMUNICATIONS SYSTEMS

A pamphlet presenting equipment for communo-phone installations for point-to-point, multiple or paging transmissions. Wired or wireless contact is described. David Bogen Co. Inc.

FRACTIONAL HP. DRIVES

Wedgbelt Drives Catalog contains specifications and prices for sheaves and belts. Condensed and simplified drive tables over range of drive ratios and center distances. American Pulley Co.

TESTING METERS

6 Instrument Bulletin No. 116 presents meters for measuring switch and contact resistance, a-c and d-c voltage ranges, output, current, capacity and decibels. Superior Instrument Co.

BALLASTS PRICES

Price List 611-01 tabulates prices of ballasts; giving power factors and cycles, voltage, watts loss, shipping weights, etc. American Transformer Co.

TACHOMETERS

A 4-page pamphlet describes the principle, advantages and uses of the tachometer; also lists range combina-

tions and presents a repair service. Herman H. Sticht Co., Inc.

INDUSTRIAL BUYER'S BULLETIN

9 16 pages of industrial products including steel files, bins and furniture; welding and soldering equipment; electric furnaces; incandescent and infrared lamps. Precision Equipment Co.

FLUORESCENT LIGHTING FIXTURES

10 Bulletin 10-B describes and illustrates industrial and commercial fixtures with dimensions and prices. Day-Brite Lighting, Inc.

FUSES

11 A 32-page catalog contains specifications on all G. E. fuses. Also treated is a technical description of shorts, overloads, tests, history, care and maintenance. General Electric Co.

GERMICIDAL DISINFECTION

12 A brochure titled "Disinfectaire" presents principles and need for electronic air disinfection. Art Metal Co.

ALUMINUM CABLE HOOKUPS

13 The story of aluminum pressure connectors is told in Bulletin No.

27. Technical and installation data on straight and angle aluminum lugs, *laboratory testing results, included. Thomas and Betts Co.

DATA ON SCREW PRODUCTS

14 "Library of Engineering Data" is set of four pocket-size cards tabulating decimal equivalents of fractions of the inch and number of twist drills. Also included are thread dimensions and weight of machine screws in "lbs. per thousand." Manufacturers Screw Products.

ELECTRICITY IN THE FOOD INDUSTRY

15 A 24-page booklet titled "Electric Equipment for Co-ordinating all Processing Operations in the Food Industry." Data on motors, controls, heaters, testing equipment, timing devices, switchgear and transformers. General Electric.

CHAIN BELTS

16 Bulletin 45-1 gives description, features, specs and prices of roller chains. Chain Belt Co.

ELECTRIC FEEDRAIL

17 Bulletin 17 shows diagram and pictures of electric feedrails in use.

Circle numbers, sign and paste on your letterhead and mail in an envelope.

ELECTRICAL CONTRACTING 330 West 42nd St. New York, 18, N. Y.

January

(Not good after March 1)

Please send me without obligation, manufacturers' literature herein described and identified by numbers circled below.

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Champion Lamps cover the full range for industrial service, including:

CHAMPION Fluorescent Lamps

white or daylight, in all standard wattages and lengths; Instant Start Fluorescent Lamps for the new instant start circuit; Low Temperature Fluorescent Lamps for cold or exposed locations.

CHAMPION Incandescent Lamps

clear, inside frost, white bowl and silvered bowl for general lighting service; Vibration Service Lamp; for general lighting service, Vibration Service Lamp; Rough Service Lamp; Spotlight, Floodlight or Reflector Lamps; Infra-Red Lamps.

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Whatever the types and sizes you need, select lamps bearing the CHAMPION Diamond mark, signifying these four "diamond points" of value.

- Champion Quality guaranteed to equal or exceed Federal Specifications.
- Champion Service trained lighting experts in the field to help you choose the one best lamp for each and every lighting application.
- Champion Economy Champion Lamps for industry are designed and distributed to assure minimum lighting cost as well as lamp cost.
- Champion Supply—through carefully selected industrial distributors equipped to meet your needs promptly and efficiently.

CHAMPION LAMP WORKS

Lynn. Massachusetts

Feedrails are enclosed electric rails which furnish power without wires to moving tools, grinders and lathes. Federal Corp.

COLOR CODE CHARTS

18 Pocket sized card and wall chart shows capacitor Dot Color Codes and Army-Navy Standards. For Mica Capacitor users. Cornell-Dubilier Elec. Corp.

THE FLUORESCENT LAMP

19 The first booklet in a series on "Know How" Lighting. Chapters tell what it is, construction, operation and advantages. A 16 page booklet. Westinghouse Electric Corp.

ELECTRICITY IN THE HOME

20 Circular No. K4.0 (8 pages) presents home electrical planning, appliances, sources, wiring and plan reading. Small Homes Council.

PORTABLE A-C TEST SETS

21 A 24-page bulletin contains data and description on complete line of test sets from 2,000 to 150,000 volts. General Electric Co.

PROTECTIVE FILM

22 A 16-page booklet "Liquid Envelope" describes the use, properties and technical data of a pealable, plastic film recommended for protecting surfaces and materials in storage or transit. Better Finishes and Coatings, Inc.

STREET LIGHTING

23 "Hints on Lighting Maintenance" is a 24-page booklet advocating regular checks for a street lighting system. Discussion of cleaning methods and compounds, reflectors and lamps. Booklet B-3455. Westinghouse Electric Co.

FRICTION SAWING

24 A 24-page booklet telling advantages and limitations of friction sawing steel, armor plate and iron. Table included for job selector. DoALL Co.

FREQUENCY METERS

25 "Frahm" Vibrating Reed Frequency Meters, Bulletin 1770, is 20-page booklet with description, uses, method of reading, construction and characteristics. James G. Biddle Co.

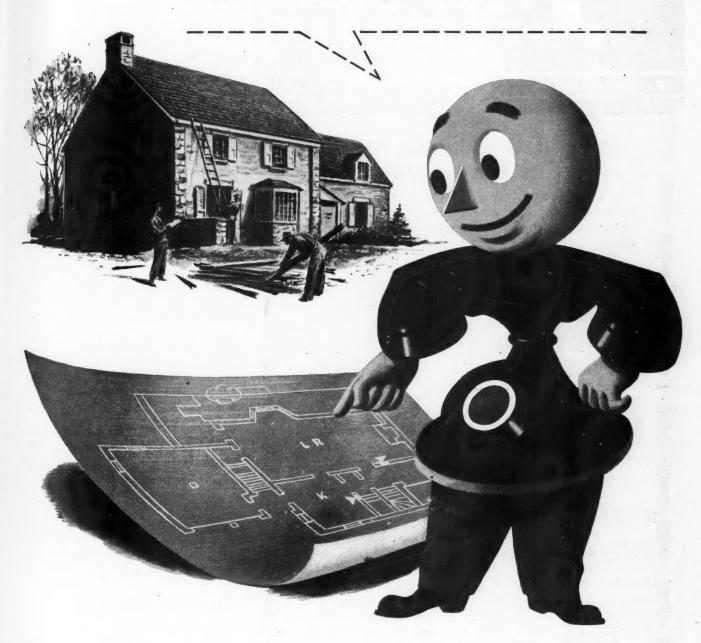
WELDED BARRELS

26 The story of welding 55-gallon steel drums picturing and explaining all processes from sheet metal to finished product. Federal Machine and Welder Co.

TONG TESTERS

27 A 6-page folder illustrating and describing types of tong-test ammeters with uses, ranges and prices. Columbia Electric Mfg. Co.

"Why not make telephone conduit a part of every contract?"



Many electrical contractors are getting additional business on every residence job by including a bid for installing conduit for built-in telephone facilities.

Telephone conduit and outlets are easy to install during construction and they offer the home buyer real telephone convenience at little extra cost. More and more architects and builders are realizing that built-in telephone facilities help to sell the house. They are a sign of good planning.

By selling more architects and builders on this idea, you can increase your contracts and your profits.

 NO ELECTRICAL CONTRACT IS REALLY COM-PLETE UNLESS IT INCLUDES CONDUIT FOR BUILT-IN TELEPHONE FACILITIES.

BELL TELEPHONE SYSTEM





Quickly Installed Latrobe Products Save Time and Labor

New construction and plant readjustments are being hastened and in many cases simplified by the use of convenient "Latrobe" products. Do not be caught short. Check your stock frequently.



FLOOR BOXES

No. 470 "Latrobe" Pipe or Conduit Hanger

Designed for hanging pipe or conduit $\frac{1}{2}$ ", $\frac{3}{4}$ " and $\frac{1}{4}$ " to steel beams up to $\frac{3}{6}$ " thick. Has firm, sure grip.



No. 150 Box; No. 207 Nozzie

Underwriters' approved. For installation in concrete or in wood finished concrete floors.



"Bull Dog" Insulator Support

Nothing better for fastening porcelain or glass insulators to exposed steel framework. No holes necessary.



WIRING SPECIALTIES

No. 280 Nozzle with No. 200 Cover Plate

Ten Amp. 250 Volt receptacle in brass housing, ½" brass pipe extension.



No. 285 "Latrobe" Double Duplex Receptacle Nozzle

Shown here with No. 200 Cover Plate. Easy to install, attractive, efficent.



Bull Dog BX Cable Staples

Superior quality. Available in any quantity.

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SILICONES

28 Catalog listing silicone products with charts and graphs showing properties. Included are fluids, greases, compounds, resins, varnishes and silastic—a silicone rubber. Dow Corning Corp.

CLASSROOM FLUORESCENT FIXTURES

29 Bulletin 50-C presents fixtures, layout arrangements and lighting curves for schoolroom lighting. Day-Brite Lighting, Inc.

RECONVERSION INVENTORY

30 Three bulletins suggest methods for testing Motors, Centrifugal Pumps and V Belt Drives with reconversion inventory and repair as the object. Allis-Chalmers Mfg. Co.

FINISHES

31 Folder presents the Wetordry for rapid finishing of metal, plastic and glass. Minnesota Mining and Mfg. Co.

M-G CHARGER

32 Bulletin 200 describes single circuit motor-generator battery-charging equipment for motorized lift trucks. Bulletin 201 presents data for four circuits. The Electric Products Co.

GROUND RESISTANCE TESTING

33 Catalog 104 explains ground resistance, the need for good grounding, methods for testing grounds, the Vibroground principle of operation, specs and prices. Associated Research, Inc.

WELDING ELECTRODES

34 Bulletin L6348-A discusses arc welding electrodes with characteristics of tips, strength, and ductility. NEMA color chart and recommended current chart also included. Allis-Chalmers Mfg. Co.

DEAD FRONT SWITCHGEAR

35 Information on metal-enclosed dead front switchgear for low voltage distributing circuits is contained in Bulletin B6376. Space requirements, rating and construction of various panel types, electrically and manually operated are presented in tabular form. Allis-Chalmers Mfg. Co.

SEEING AID

36 Pamphlet presents combination magnifying-illuminating unit as aid in fine precision work. Scherr Magni-Ray.

FREQUENCY METERS

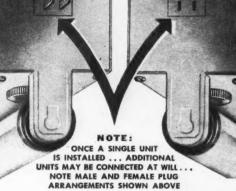
37 Bulletin VF-43-IC describes principle on which Vibrating Reed Frequency Meters work. Also presented is wide variety of meters with notations as to use and installation. J-B-T Instruments, Inc.

FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA



^{tr}Add-A-Light" can be installed anywhere without regard to existing outlets. Basic strips and attachments come in convenient 24, 48 and 96 inch lengths.

Moe-Bridges built-in quality throughout, with Underwriter approved ballasts, starters, and lamp holders.



FOR REPLACEMENT USE

IN HOME, OFFICE, STORE OR FACTORY

• Retail stores that want to market fluorescent lighting units in the same simple manner as they sell portable appliances will find "Add-A-Light" the ideal answer to their problem. "Add-A-Light" is easy to sell because there are so many requirements in home, store and office lighting that it will fulfill. It is equally as efficient for complete new installations . . . the replacement market . . . or as a supplement to existing equipment. "Add-A-Light" is easy to install because any existing outlet in a room serves one or a dozen units . . . it can be mounted on picture hooks or permanently installed with 'wood screws . . . it can be connected vertically or horizontally on walls, on ceilings, over doors and windows . . . it can be connected as an individual unit, to completely encircle a room, or extend the full length of a building. "Add-A-Light" is simple to stock and cuts down inventories, because there is only one basic strip . . . with separate reflector and shade attachments to complete the line. Dealers who want to do a real "package merchandise" lighting job without the usual complications are requested to ask their Jobber for information on "Add-A-Light"-It's really something new.



Above . . . "Add-A-Light" with plastic enclosure in one of dozens of applications easily adapted to office, store, or residential lighting.



Above . . . "Add-A-Light" with ornamental lowere attachment for decorative lighting in stores, beauty shops, homes, etc. One outlet handles entire installation.





HOT DIP PROTECTIVE COATING

38 Technical Service Bulletin 14 gives specifications and methods for applying Dipwrap, a protection against corrosion recommended for cutting edges, gears, pinions, etc. Paisley Products.

SWITCHBREAKER

39 Pamphlet presents construction, uses and advantages of fuse-less switchbreakers. Code Electric Products Corp.

MERCHANDISING CATALOG

40 Features complete line of safety switches, service controls, multibreakers and electrical specialties. Cutler-Hammer, Inc.

SCREWDRIVER

41 Folder illustrates tool driver with detachable blades to fit any size screw in use. Speedway Enginering Co.

LIGHTING AND CONTROLS

42 Catalog 945 uses photographs, drawings and specifications to present equipment and installation methods of stage and theatre lighting. Incandescent and fluorescent lamps are discussed. Hub Electric Co.

TEXTILE EQUIPMENT

43 Booklet B-3466 describes full line of electrical equipment for cotton mill operation. Slasher drives, motors, controls for warpers and winders, lighting and electronic air cleaners are presented. Westinghouse Electric Corp.

TRANSFORMERS

44 Transformers for 16 fields of application including power circuit, mercury lamp, neon, signal and street lighting are presented in Catalog 451-GB. Fuses and ballasts also receive descriptive attention. Jefferson Electric Co.

CONVERSION FACTORS

45 Over 600 conversion factors commonly used by electrical engineers as well as definitions of basic units, prefixes, mensuration and temperature conversion factors are arranged in alphabetical order in the 8-page folder, "Conversion Factors and Formulas for Electrical Engineers." The lists are arranged for use in either a loose-leaf binder or for desk or wall mounting. I-T-E Circuit Breaker Co.

MERCHANDISING POLICY

46 A 12-page booklet discusses the distribution, merchandising allocations, prices, new models and service of this company manufacturing automatic heating appliances. Proctor Electric Co.

RESISTANCE HEATING

47 "An Improved System of Electrical Resistance Heating" is a treatise on the system of woven elements in fabric. This discussion explains the use



sects from collecting within fixture at apex.

SLIDE-HINGED DIFFUSERS (patent pending)...
Diffuser panels are mounted by ingenious invisible hinges which permit panels to be opened to the cleaning position by easy upward motion of one hand. NEW DEMOUNTABLE CONSTRUCTION... Diffuser panels may readily be detached from chassis to facilitate maintenance. No screws, bolts or straps. INDIVIDUAL PACKING ... Each LINOLITE 4000 fixture comes packed in custom designed protective container.

Ever since 1857, Frink has specialized in lighting engineered for vision. Today many of America's finest banks, stores, offices, libraries and utilities benefit from up-to-the-minute fluorescent lighting equipment custom designed by Frink. Our staff of expert engineers and designers is now at your disposal for prompt advice on fluorescent lighting problems.



THE FRINK CORPORATION, Bridge Plaza North, Long Island City 1, New York Subsidiaries: STERLING BRONZE COMPANY, Inc. . BARKON-FRINK TUBE LIGHTING CORP.

WITH I -I -N-O -I -I -I -I DO



of fibre glass, asbestos yarn, organic resins, silicone resins and ceramics in woven heating structures. Safeway Heat Elements, Inc.

CERAMIC CAPACITORS

48 Folder listing specifications and characteristics of silver electrode ceramic capacitors also diagrams, construction details, and includes color code. Electrical Reactance Corp.

CARBON BRUSHES

49 Catalog 95 gives description and characteristics of various grades and styles of carbon brushes. Helwig Co.

SEALED MOTORS

50 A folder with cutaway view, photographs and technical discussion of 2 to 15 hp. sealed motors for use in dusty, moist and corrosive atmospheres. CrockerWheeler Div. of Joshua Hendy Iron Works.

ELECTRICAL INDICATORS

51 A 28-page catalog describes the development, production procedures, and tests of standard and sealed electrical indicating instruments. Also presented are factors involved in the uses of instruments, and planned to guide the buyer to the right equipment for his particular problem. Marion Electrical Instrument Co.

OIL MAINTENANCE

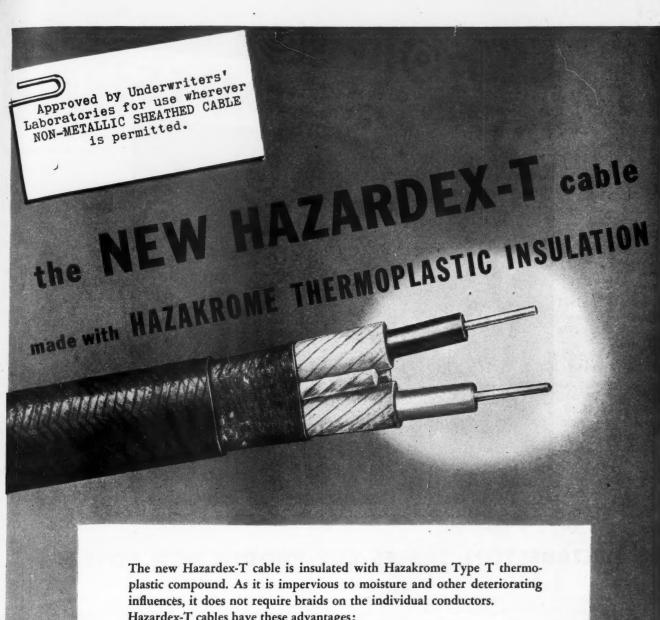
52 A 12-page bulletin discusses "How to Completely Clean. Dehydrate, Degasify and Stabilize Oils" used in transformers, circuit-breakers, oil-filled cable, turbines, vacuum pumps and bearings. Buckeye Laboratories Corp.

BATTERY CHARGERS

53 Bulletin 203 discusses automatic chargers for either lead or Edison batteries used in powering industrial trucks, tractors and locomotives. Single and multiple circuit chargers are included. Electric Products Co.



S. Martin Streed, chief electrical inspector of Minneapolis, seeks advice of N.F.P.A. Electrical Committee member M. M. Brandon (right), New York City, on the proposed Minneapolis city rules for insulation of high voltage tube lighting.



Hazardex-T cables have these advantages:

SMALL SIZE - A 2/64" wall of Hazakrome instead of 3/64" wall of rubber insulation. The absence of braids further decreases the diameter of Hazardex-T cable.

LIGHT WEIGHT - The smaller dimensions mean a lighter weight cable.

GREATER CARRYING CAPACITY - Hazardex-T cable has a rated limit of 60°C. copper temperature, while Hazardex with Type R insulation has a rating of 50°C.

Hazardex-T is designed for inside lighting and appliance circuits. It is flexible, smooth, clean and dry. It is also easy to strip, splice, and install with standard wiring devices, making handling costs low.

Further information and samples gladly supplied on request. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

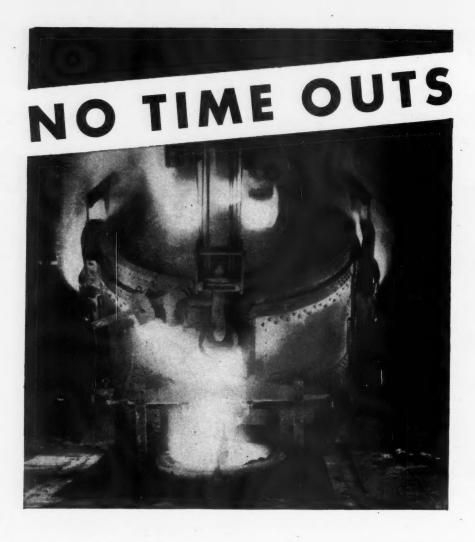


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DELTABESTON CABLES CUT PRODUCTION LOSSES

Inexcusable are the losses in time, labor and production caused by unexpected failure of power lines or lighting circuits in boiler rooms, steam tunnels, pouring ladles or other torrid zones. A safe way to provide uninterrupted electrical service is to rewire with Deltabeston Asbestosinsulated Cables.

These tough, heat-resistant cables have proved in countless installations that their asbestos insulation just won't bake out despite constant high heat. Deltabeston is constructed to fortify electrical circuits with extra protection in installations where excessive heat, humidity and most corrosive vapors prevail.

Where heat is a problem, investigate G-E Deltabeston Asbestos-insulated Cables. They save many hours of maintenance time in steel mills, mines and power plants where scorching heat ruins ordinary cables. General Electric manufactures a complete line of asbestos insulated cables including many special designs.

For additional information write to Section Y162-8, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn. Deltabeston Wires and Cables are distributed nationally by Graybar Electric Co., General Electric Supply Corporation and other General Electric Merchandise Distributors.

Here Are Five Reasons
Why Deltabeston Cables
Give Trouble-Free Service

- 1. SOFT FINE COPPER STRANDS— Offer maximum flexibility and withstand severe vibration.
- 2. HEATPROOF FELTED ASBESTOS— Protects cable against overload conductor heat.
- 3. VARNISHED CAMBRIC—Increases dielectric strength and resistance to electrical leakage.
- 4. FELTED ASBESTOS—Safeguards against high ambient temperatures.
- 5. ASBESTOS BRAID Furnishes high resistance to heat, moisture, oil, grease and most corrosive vapors.



GENERAL & ELECTRIC

IN THE NEWS

NEW PRIORITY PROGRAM FOR HOUSING CONSTRUCTION

The year 1945 closed with the nation facing the worst housing crisis in its history. Veterans, returning from war theatres at the rate of several thousand daily, had to double-up in already overcrowded homes. All signs indicated that the situation would become worse before it improved.

Housing under construction throughout the nation totalled some 75,000 houses. Material shortages, high labor costs, OPA rent ceilings—all tended to

retard housebuilding.

After a thorough study of the housing problem by the Office of War Mobilization and Reconversion, its director, John W. Snyder, called an industry-government two-day housing conference in mid-December. This conference concluded with an executive session working out a plan for the building of 500,000 homes in 1946. The OWMR director stressed at this conference that a large proportion of the homes built in 1946 should be offered for sale or rent "well under" the \$10,000 limit proposed by his agency and indorsed by President Truman.

Following the housing conference, Priorities Regulation 33 was issued by Civilian Production Administration, peacetime equivalent and successor to the War Production Board. This regulation provides for priorities assistance for moderate-cost housing to which veterans of World War II, including merchant seamen, will be given preference, it was announced by CPA Administrator John D. Small. The regulation became

effective January 15, 1946.

The new regulation establishes an HH rating for ten housing materials which are in critically short supply. These ratings will be issued by the Federal Housing Administration's fifty-three field offices to 1) individual veterans who wish to build for themselves or, 2) builders who wish to erect one or more dwellings, and agree to offer for sale or rent only to veterans during construction and for thirty days thereafter. FHA was delegated power to award this rating by the CPA through the National Housing Agency. Authority for the new program is vested in CPA by the second War Powers Act, renewed for six months through June 30, 1946.

The further requirement is made that each unit shall be built to sell for not more than \$10,000 (finished price, including land and improvements) or to rent for not more than \$80 per month. Housing construction begun before January 15, 1946, the date when PR 33 became effective, may be brought within the program upon application to FHA, if it meets the standards of the regulation.

Building materials to which priorities are assigned under the terms of PR 33 are: common and face brick, clay sewer pipe, structural tile, gypsum board, gypsum lath, cast iron soil pipe and fittings, cast iron radiation, bath tubs, lumber and mill work.

Principal provisions of the new regu-

lation, drawn up at the direction of President Truman in a move to ease the acute housing shortage, were outlined by CPA officials as follows:

1. An applicant for the HH rating must give in general, specifications of what he plans to build under the reconversion housing program and the price or rental at which he will make it available to veterans. The FHA must be satisfied that the proposed price or rent is reasonably related to the proposed accommodations.

2. Applicants must show to the appropriate FHA field office that they will be ready to start construction within sixty days. The applicants must demonstrate that they have effective control of the land, that financing is assured,



PAR FANS MOTORS CONTROLS

PROMPT SHIPMENT FROM LARGE STOCKS **AUTHORIZED PARTS DISTRIBUTOR**

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less ins & Myers

READING ELECTRIC COMPANY. INC.

Parts Distributors for the Manufacturer

200 William St.

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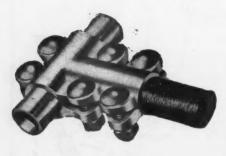
New York 8, N. Y.

rankel

HEAVY DUTY

TAP CONNECTOR

FOR COPPER TUBING. ROUND BAR, AND CABLE



Pipe and bar contacts are precision ground for maximum contact. Cable contacts are rough for maximum gripping and contact. Connector body of electrical bronze. Oval shank Everdur bolts are used for clamping. Require only one wrench to tighten, and guaranteed against season cracking.

Solderles Connectors

Catalog No. 4-C, yours for the asking.

RANKEL CONNECTOR 27 VESTRY STREET · NEW YORK 13, N. Y. and that arrangements have been made for local building permits, utility services and the like. If construction has not been started within sixty days the HH rating becomes void and a new application must be filed.

3. An applicant must agree to make the housing available only to veterans during the period of construction and for thirty days thereafter, at the conclusion of which period he may sell or rent to a non-veteran, but on the same terms which he had agreed to make available to the veteran.

4. In his sales agreement a veteran or other purchaser is pledged to the same thirty-day waiting period exclusively for other veterans in the case of a resale and the sale must be made at or below the maximum sales prices originally paid.

5. The regulation has also been written so as to provide for conversion of existing construction where it can be shown that it will result in increased housing facilities.

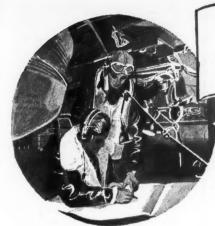
6. The regulation was written not only to provide moderate priced houses and multiple-unit dwellings for rental but also dormitories or group housing for educational institutions for the benefit of veterans.

LUSH MARKET AWAITS DAKOTA'S RURAL CONTRACTORS

North Dakota's economic picture is one that would make any business man's mouth water. For the first time in many years the farmers have money-plenty of it. They are and will be spending it -cautiously and intelligently-not for



Enjoying a bit of relaxation at recent Chicago inspectors meeting are (L to R) Frank H. Clingan, electrical engineer, Detroit Board of Education; Fred B. Adam, president, Frank Adam Electric Co., St. Louis; and Rudolph Hultgren, vice-president, General Luminescent Corp., Chicago.



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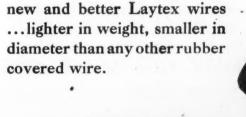
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furs and jewelry and other so-called luxuries, but for the conveniences of comfortable living. Topping the farmer's priority list of things wanted most is electric service with all the labor saving devices that accompany such an installation. They want it now and are willing to pay a reasonable price for an A-1 wiring job.

That was the general picture that evolved from discussions with some of the 70 electrical contractors and guests registered at the first postwar conference of the North Dakota Electrical Contractors Association at the Gardner Hotel, Fargo, N. D., on Dec. 10-11. Despite storms and a rugged 20 below zero temperature these contractors came to the conference seeking advice and solutions to their critical skilled manpower shortage problem and a none-too-encouraging materials situation. They knew the conditions in their own localities but they wanted a state-wide picture. They found some of the answers in the full two-day program.

An open forum on farmstead wiring prices at the initial session evoked some rather heated discussion, particularly on the reported REA prices of \$2.75 to \$3.25 per outlet. Contractors asserted that they cannot afford to do work at this scale with labor costs practically doubled and material costs up. They are now getting from \$4.00 to \$5.00 per outlet for this work—considered reasonable since wiring is done in old existing structures. That farmers are willing to pay this for a good wiring job, was the concensus of contractor opinion.

Lack of REA electrical inspection in that territory and the pernicious practice of some co-op superintendents permitting unlicensed men to do farm wiring was soundly attacked by the contractor group. Admitting rural inspection



Ohio Leaguers at Chicago IAEL conference (L to R) Brooks H. Harmon, Gas and Electric League of Dayton; and E. J. McGinnis, Cincinnati Electric Association.



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Newly elected second vice-president, Southwestern Section, Harry C. Moore, Modesto City inspector, and Harry Romock, San Francisco inspector, chairman, Northern California Chapter.

laxity in the Dakotas in the past, C. H. Carl, REA, St. Louis, promised a rigid inspection policy in the future and assured the contractors that any reported unlicensed wiring will be stopped.

An REA program to wire 10,000 North Dakota farms per year for the next five years was outlined by James Coleman, secretary of the North Dakota Association of Co-ops. Against a total generating capacity of 90,000 kw., some 50,000 kw. are needed to adequately serve one area alone, he revealed, adding that 14 new cooperatives have been organized to adequately cover the state. Ten of these will start construction next summer. All projects will have their own inspectors; follow standard set of specifications; use standard electrician's report and inspection forms. Project managers are interested in working with established electrical contractors, Mr. Coleman advised. Unless enough wiremen can be trained to do farm wiring, however, the farmers will be forced to do their own wiring, he warned.

The toughest hurdle facing the contractors is the critical shortage of trained electricians throughout the state. Some measure of relief is due in the summer of 1946 when 100 trained helpers will be available, according to Karl Larson of the Wahpeton State Science School. A special three-month course for retraining ex-servicemen who have had the equivalent of two years previous electrical experience will start Jan. 1, he advised. This rural wiring course will devote about 75 percent of the time to actual wiring techniques and problems, the remainder covering elementary theory and code study. The school's regular two year electrical course has 135 students (71 of them veterans), 23 of whom will be graduated in the spring. About 100 more are expected to enroll in January. These students receive a bal-



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anced course covering wiring, motor repairing, refrigeration and radio servicing, bookkeeping, catalog and code study, he revealed. Mr. Larson predicted there would be enough electricians in North Dakota to do farmstead wiring when materials are readily available. That is the goal toward which the school—with its short course—is working.

Confusion over training of ex-servicemen was cleared by W. R. Johnson, Veterans Administration, Fargo, who outlined in detail the requirements of Public Law 16 (training of handicapped disabled veterans) and training under the GI Bill of Rights. He emphatically pointed out that the VA payments to disabled men are to aid them until they become firmly established in a job and are not to be construed as a subsidy to the employer. There have been some cases where employers have taken this attitude and reduced wages to a substandard scale, he revealed. To intelligently evaluate an ex-serviceman's past experience in the electrical field, Mr. Johnson suggested the appointment of a committee comprised of a representative of the electrical contractors association, the State Board of Electricity and the electrical union.

Every rural electrical contractor is vitally interested in the merchandising of electrical appliances. When he wires a farm, he also tries to do a selling job on the "convenience" angle of electrical service. The basis of all appliance sales—adequate wiring—rests with the electrical contractor, asserted Byron Hanson, Northern States Power Company. Despite an almost unlimited appliance potential, contractor-dealers must face the fact that more dealers are going into the electrical appliance field. Consequently a strong sales organization should be set up and salesmen should be selected and adequately trained now—men who



From Jackson, Michigan, came A. W. Rauth (left) and K. J. Goss of Consumers Power Company electrical laboratory to get latest code data at Western Section, I.A.E.I. meeting in Chicago.



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Vying for the cribbage championship of the IAEI — presidents E. E. Lawson, Riverside, California, President Southwestern Section, and L. P. Dendel, Lansing, Michigan, President of IAEI

will make appliance selling their career and really bring in the business, he cautioned. He revealed that his company was planning to aggressively promote and sell appliances and also maintain prices.

With the anticipated increase in available goods and the increase in business personnel, bookkeeping burdens are going to become heavier, warned Wm. A. Ritt, Minneapolis, secretary-manager of the Minnesota Electrical Council. To survive, business must have a sound accounting system. The hit or miss methods of the past will lead only to confusion and failure as it did then. A clean cut, systematized business is not only impressive but eliminates 90 per cent of customer arguments, Mr. Ritt asserted. Contractors also need more accurate control of material and time in their work, he added, as he demonstrated a number of accounting and control systems designed for various sized business enterprises. These have been thoroughly tested by the members of the Minnesota Electrical Council.

An insight into the 1946 National Electrical Code was presented by Glenn Rowell, Fire Underwriters Inspection Bureau, Minneapolis, who outlined in detail the various changes approved at the October meeting of the NFPA Electrical Committee in Chicago. Considerable time was devoted to the new conductor capacities and grounding techniques as applied to farmstead wiring.

The wartime development in the electronics field will bear a number of postwar chore-boys, declared W. R. Mauseth, manager, electronics division, Dakota Electric Supply, Fargo, as he portrayed a new era of electrical control. Lighting systems, railroad crossing gates, traffic systems and speed calculators, two-way radio-telephone, safety devices for land, sea and air travel, were a few of the postwar applications he listed for electronic devices.

Convention delegates had a comprehensive review of old light sources and



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Hoosiers R. D. MacDaniel, Indianapolis, vice-president, Grain Dealers National Mutual Fire Insurance Co., and A. H. Welkin, chief electrical inspector, Ft. Wayne, enjoy lobby confab during Western Section, I.A.E.I. conference in Chicago.

received valuable information on new light sources and their postwar applications from L. B. Paist, lighting engineer, Northern States Power Company. One of the first compilations of Slimline fluorescent lamp and ballast characteristics and efficiencies (based on G. E. data) was presented by Mr. Paist. B. C. B. Tighe, Supt., Fargo schools,

B. C. B. Tighe, Supt., Fargo schools, while discussing the business outlook, asserted that bank deposits today are the highest in the history of North Dakota; that the state has lead the nation in E Bond sales in every war and victory drive. With this as a reserve and flax—an important state crop—still on the nation's shortage list, there is no cause for pessimism in the business field, he concluded.

The electrical contracting industry is on a "big business" plane and is ready to tackle the huge postwar task of electrical rehabilitation and modernization in the nation's industrial, commercial, rural and residential fields, stated August Eckel, middle west editor, Electrical Contracting. Awaiting the electrical contractor is a projected postwar construction volume of some 231 billion dollars; a 3 billion dollar farm wiring market plus a vast farm rewiring potential; a tremendous electrical modernization market that holds a potential of one billion dollars in office and store lighting equipment alone, he revealed. Every contractor will be busy for the next three to five years with his share of this combined market. The degree of his success rests in his own hands, for it is the individual contractor's responsibility to plan and estimate intelligently, keep accurate cost records and study and apply the latest equipment developments and installation techniques, Mr. Eckel concluded.

Two films were featured at the twoday session. B. R. Bunn, WESCO, Minneapolis, presented the Westinghouse technicolor sound film on better living through adequate wiring and Fred Trayser, G. E. Co., Minneapolis showed the current armoured cable film "Manufacture of Electrical Cable." B. K. Skeels, Bismark, N. D., concluded the formal program by recounting the history, progress and aims of the North Dakota Electrical Contractors Assn.

At the business session, action was taken to defer group affilation with the Minnesota Electrical Council until the spring meeting which will be held at Dickinson, N. D. New officers will be elected at that time. Present officers are: president—Clyde Kieley, Grafton Electric Co., Grafton; vice-president—Carl Wild, Wild Electric, Milton; secretary-treasurer—George C. Hilstad, Traill County Electric, Mayville.

CAROLINA CONTRACTORS MEET AT CHARLOTTE

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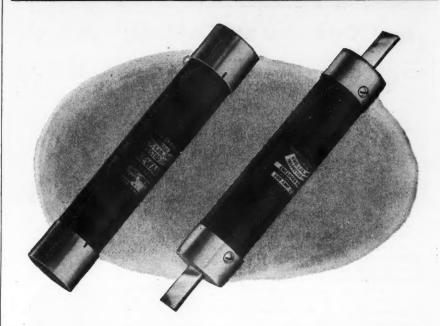
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The North Carolina Chapter of NECA held an industry conference in Charlotte, North Carolina, December 5th and 6th, with John Bolen, President, presiding. The discussions centered around problems of cooperation between electrical contractors and other electrical industry groups.

The sessions were headed off by S. Paul Vecker, Vice-President, Carolina Power and Light Company of Raleigh, North Carolina, who spoke on "Expanding the Sellers' Market." "I am convinced," he said "that no segment of our economy can have a more important influence upon the expansion of the market within the industry with which you are associated than that segment represented by the contracting and building trades. Together we have solved many a problem which confronted us in the formative stages of our development. Certainly, the problem of labor and material which confronts us in supplying the demand now existing can be solved, providing we premise our policy on a fair profit."

Howard Pancoast of Bryant Electric Company, High Point, North Carolina, took up industry relations from the standpoint of problems facing the electrical contractor. He urged the contractors to seek out effective goals. "We must realize," he said, "that guaranteed profits, inefficient operation, slip-shod methods, incompetent help and the use of any available materials is out. It must be replaced by a policy which serves the best interests of our customers and the general public, as well as our own. Our goal should be to provide the maximum value at the minimum cost, consistent with sound business practice.'

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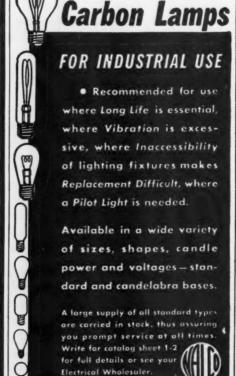
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tomers are expecting a higher standard of service than we have offered in the past. They want advice on new materials, methods and equipment. They will expect us to have engineering talent, test equipment and technical data available."

Labor relations in the industry and the necessary elements of labor cooperation were reviewed by Charles S. Thurber, Southeast representative of NECA. Charles A. Pyle, Manager of the National Electrical Wholesalers Association and N. J. McDonald, Vice-President of Thomas & Betts Company, reviewed the position of the manufacturer and the wholesaler in the distribution of electrical products. Mr. McDonald outlined the function of the wholesaler in providing efficient and low-cost handling of the great variety of products which go into the electrical job.

Robert W. McChesney, President of the National Electrical Contractors Association, emphasized the need for team work between all parts of the electrical industry. For the contractor he urged that "our approach to our job must include effective performance as an efficient distributor of electrical materials and equipment as well as providing a qualified installation service. We must become, and become known as, a necessary link in the chain of distribution in our industry and not merely as a provider of labor and engineering skill."

The lighting market came in for intensive discussion through an entertaining demonstration by Paul T. Tysinger, Lighting Supervisor of the Duke Power Company, a review of lighting tools by H. M. Horton of the General Electric Company and a discussion of fixture design by R. D. Bradley of Daybrite Lighting, Inc. E. S. Northup of the National Adequate Wiring Bureau explained the progress of adequate wiring promotion and the sales help available through the N.A.W.B.

CHICAGO EME'S ELECT '46 SLATE

Harry Buckles, Ingersoll Steel Disc Co., was elected president of the Chicago Electrical Maintenance Engineers at a recent meeting of that group. Other officers elected at the time include: vice-president, R. H. Keil, Western Electric Co.; secretary-treasurer, R. J. MacLaren, Chicago Electric Association

Directors elected for a three-year term are: Paul J. Anderson, Link Belt Co.; John C. Howard, Standard Oil Company of Indiana; George Palm, Electro Motive Corp.; and J. H. Miller, Wisconsin Steel Company.

PAUL GEARY APPOINTED EXECUTIVE VICE PRESIDENT OF NECA

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Paul M. Geary has been appointed to serve as NECA's first executive vice president. He assumed his duties in Washington, D. C., January first. The position was created by the Association at its fall Cleveland meeting and is intended to relieve the elected president from many burdensome details of association business. Mr. Geary has been connected with NECA for seventeen years, his initial position being that of manager for the Youngstown, Ohio, Chapter and his most recent being in the capacity of assistant general manager. During this span of service he was active in organizing the IBEW Employers section, NECA; in furthering the association's effective labor-management policy of cooperation and in organizing the association's field service. As NECA's Labor Relations director as well as an industrial member of the Wage Adjustment Board his ability and energies have become widely recognized in the industry.

Leo H. Cleary, also of Washington, was appointed simultaneously to the newly-created post of technical director and is now in charge of research and statistics, compiling the Manual of Labor Units and Cost Data and consultant problems for various code, standards and technical committees in the electrical industry. With more than a quarter of a century in the electrical contracting field, Mr. Cleary has been treasurer of the National Society of Professional Engineers, a Fellow of the American Institute of Electrical Engi-



Paul M. Geary, executive vice president for NECA, steps into newly created role.



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R&S explosion-proof lighting fixtures are supplied with a standardized base common to all sizes. Reflector globe assemblies of various capacities are interchangeable to suit conditions. No need to disturb mounting or electrical connections. Modern design simplifies mounting and affords a variety of conduit arrangements in one standard base. Installation costs are accordingly low, parts fewer and ordering easier.

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neers, secretary-treasurer of the AIEE Washington section and vice chairman of the Capital section of the Illuminating Engineering Society.

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The "Victory Lighting Jubilee," held at the 17th Regiment Armory in New York City, closed November 30, 1945, after a successful five days' showing. It was sponsored by the Lamp Department of the General Electric Company and 134 manufacturers of lighting equipment. Although not open to the general public, over 12,000 visitors viewed the exhibits in this first postwar industry lighting exhibition. These visitors represented the electrical industry, electrical utilities, chain stores, furniture and department stores, building and architectural fields.

This lighting exposition, acclaimed the largest and most comprehensive in the history of the lighting industry, presented displays of both lighting fixture and portable lamp manufacturers. It featured the combined talents of these two groups in practically every type of fixture and lighting device, designed for industrial, commercial, residential and spectacular lighting needs.

The main floor of the Armory was entirely filled with exhibit booths, in which the lighting manufacturers displayed their recent and up-to-the-minute designs of lighting fixtures, portable lamps, luminous signs, germicidal units



E. D. Stryker, sales manager, lighting equipment promotion for the G. E. Lamp Department, Nela Park, conceived and managed the Victory Lighting Jubilee exposition.

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2. ELECTRONICS DICTIONARY

By Nelson M. Cooke, Lt. Com., U. S. N., and John Markus, Associate Editor, Electronica. 433 pages, 5% x 8%, over 600 illustrations, \$5.00 An authoritative dictionary containing accurate, understandable definitions for nearly 6500 terms used in radio, television, industrial electronics, facsimile, sound recording, etc. More than 600 appropriate diagrams and sketches illustrate the principles and equipment described. Of value as a reference book for editors and engineering secretaries as well as for engineers and students.

3. ELECTRICAL COILS AND CONDUCTORS

Their Electrical Characteristics and Theory

By Herbert Bristol Dwight, Massachusetts Institute of Technology, 351 pages, 5½ x 8¾, 85 illustrations, \$5.00

85 illustrations, \$5.00

Gives the electrical engineer an excellent one-volume compilation of material for the theoretical and numerical computation of coils and conductors. Especially important is the treatment of cylindrical coils without fron cores, and heavy conductors. Among the many problems taken up in detail are magnetic field strength, self-and mutual inductance, mechanical force, skin effect, and eddy-current loss. Gives widely useful formulas having many practical applications.

4. TRANSMISSION LINES, ANTENNAS, AND WAVE GUIDES

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Transmission lines are presented exclusively from the high frequency point of view; antennas are presented from the point of view of electromagnetic theory; and wave guides are presented from the point of view of generalized transmission circuits. There is a brief treatment of wave propagation.

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and infra-red equipment. Over 1000 lighting units were on exhibit, and included fluorescent, incandescent and mercury vapor fixtures for industrial, commercial and residential lighting. There were flush mounted single and continuous row units, combination fluorescent and incandescent fixtures, surface mounted and suspension type ceiling units, floor lamps, wall, table and desk lamps, spotlights and floodlights, localized lighting industrial units, infrared demonstrators, germicidal units for various mounting methods and applications, and many others.

The exhibit area of 40,000 square feet was lighted with more than 3,000 lamp bulbs, and fluorescent lamp tubes of 73

different kinds.

One unique feature of the exhibit was an installation of 40 G. E. germicidal lamps to protect visitors, exhibitors, and employees against contraction of respiratory infections. The Victory Lighting Jubilee was reported to be the first exposition to use this protective service.

Recent developments of the Nela Park laboratories were on display in the General Electric Lamp Department exhibit. These included demonstrations of new phosphors, sealed beam type lamps, photo lamps, and the new repeating flash in action. Over 2,000 different lamps, ranging from the new 8-foot "slimline" fluorescent lamps to tiny surgical instrument beams were featured. Combined with this exhibit was a showing of two new color films by General Electric, "The Magic of Fluorescence" and "Seeing is the Biggest Thing in Selling."

The Victory Lighting Jubilee was conceived by E. D. Stryker, sales manager of lighting equipment promotion for G. E. Lamp Department, Nela Park, Cleveland. Its primary objective was the collective presentation of all postwar thinking and designing of the fixture and lamp industry, and stimulation of public interest in postwar lighting.

CALIFORNIA WIREMEN WIN WAGE INCREASE

The Fresno Electrical Contractors Association in Fresno, Kings, Tulare and Madera counties of California have entered a new agreement with union wiremen who will now receive \$2 per hour on a basic 7-hour day. Overtime will be paid on a time and a half basis instead of the double time now paid. The contract becomes effective when approved by the Wage Adjustment Board or when federal controls are lifted, whichever occurs first. Agreements also are pending with neon shop contractors, setting up a \$2 hourly scale for neon electricians and tube benders, and \$1.50 an hour for neon service men.



• Safe wiring is a MUST for consumers served under the Rural Electrification Administration! The new R.E.A. "Specifications for Wiring" point the way to safety with approved materials and methods...giving an O.K. to the PORCELAIN way!

Porcelain Outlet Boxes and Porcelain Protected Wiring best serve the requirements of R.E.A., which stipulate that non-metallic outlet boxes shall be used with knob and tube and nonmetallic sheathed cable wiring.

Whether it's farm or city electrical work — PORCELAIN offers unbeatable time-proven advantages for safe, durable, economical wiring. Ask your Electrical Inspector about nonmetallic wiring with Porcelain for safety. Write for wiring manual.





They permit easy installation in fixtures where only a limited space is allowed for ballasts. Designed by expert lighting engineers and approved by Underwriters Laboratories, "Advance" ballasts are the answer to all fluorescent lighting problems. LARGE MANUFACTURERS OF LIGHTING FIXTURES USE "ADVANCE" BALLASTS—so insist on this quality ballasts on the equipment YOU buy.

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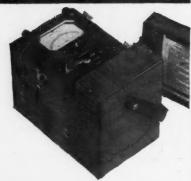
No, we don't ship ILSCO CONNECTORS in fancy jewel cases. Nor do we make them from castings which are heavy, costly and of poor conductivity when compared to the pure 99.99% electrolytic copper of 100% conductivity used in all ILSCO CONNECTORS.

Remember — it isn't weight that counts . . . it's conductivity!

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Test Potential to 600 Volts DC. Ranges to 1000 megohms with two or three additional ohm ranges in each instrument. Long mirror scales, hand drawn, individually calibrated, with more scale divisions for superior readability and split hair accuracy. Automatically decreasing test potential protects equipment of low resistance value.

Truly a Precision Instrument
WRITE FOR BULLETIN 445





Electrical safety in Saginaw, Michigan, is under the supervision of city electrical inspector John C. Denner, who is also chairman of the Western Section, I.A.E.I. Article 240 Committee.

ELECTRICAL OPPORTUNITIES EXTENDED TO VETERANS

Augmenting federal and state projects for war-vet re-employment, the Cincinnati Electrical Association has created a committee to interview, council and direct ex-servicemen to potential employers in the electrical field.

All local draft boards and members of the C.E.A. have been urged to publicize this very worthy undertaking which has the double aim of injecting new blood into the electrical industry.

Applications for positions are being addressed to Mr. Frank W. Willey, chairman of the operating committee, via the Association office located in the Cincinnati Chamber of Commerce Building.

ORGANIZE TWO-STATE ELECTRICAL COUNCIL

Electrical industry leaders in eastern Nebraska and southwestern Iowa recently organized the Nebraska-Iowa Electrical Council. Permanent head-quarters are at 1306 Woodman of the World Building in Omaha. Appointed to coordinate the various activities is J. J. Dore, secretary-manager of the new group.

The new Council, patterned after similar organizations operating successfully throughout the nation's major trade areas, represents all branches of the electrical industry—contractors, wholesalers, retailers, manufacturers and their agents, and utilities. Prime goal of the new industry group is to promote elec-

trical products and service through the medium of educational activities and transmit the benefits to the consuming public.

At the first general meeting of the Council held on Nov. 27, the officers outlined the activities to be sponsored by the group. These include: "Futurized Homes"; adequate wiring, proper use of electrical servants; and commercial modernization.

Officers of the Council are: President—H. G. Carlson; first vice-president—George C. Carter; second vice-president—Sam C. Dodson; treasurer—A. V. Sorenson; and secretary-manager—J. J. Dore.

MINNESOTA CONTRACTORS AND ARCHITECTS REACH AGREEMENT

Last year the Minnesota Electrical Council, in its Council Postwar Planning Report, (E. C. May 1944, pg. 39) set forth a number of points that would pave the way for a more satisfactory working relationship between the architect and electrical contractor. Some months ago, a committee of the Electrical Council negotiated with a committee representing the Minnesota Architects Association. The result was a joint approval of the points listed in the following agreement:

Points agreed on by joint committee representing Minnesota Electrical Coun-



W. B. Frackleton, electronic specialist, General Electric Co., Chicago, emphasizes a point in his industrial electronic applications talk before the recent Western Section, I.A.E.I. conference in Chicago.

THE REFLECTOR IS THE BACKBONE OF ANY LIGHTING SYSTEM . . .



Does Your Plant Promote Visual Skill?

There's a kind of skill that many manufacturing plants encourage to the highest degree and thereby increase production and profits. This is visual skill – the ability of the worker to "see faster", to set up his work, use his tools, read calibrations and make inspections more quickly and efficiently. There's one sure way to promote this – by the use of Skilled Lighting!

Wheeler has specialized in the study of visual skills and in designing and producing lighting equipment to meet all requirements—equipment that extracts maximum illumination from standard lamps. Wheeler's line of reflectors is made for long, efficient service—high grade, heavy duty materials with enduring vitreous enameling.

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Available for two or three 40-watt, or two 100-watt lamps. Broad wiring channel with accessible, enclosed ballast. Can be mounted from chain or conduit, individually or in continuous runs.



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NEW INTERNAL TERMINAL BOARD

TERMINAL BOARD IMMEDIATELY ACCESSIBLE—A few turns with a screw driver and the cover slips off, completely exposing the terminal board, providing a large and convenient working area.

EASY TO CHANGE VOLTAGES—Bus Bars are provided for easy changing of voltages. By simply changing their position on terminal studs you can obtain any voltage combination desired within limitation of the transformer.

NO TEDIOUS, COSTLY SOLDER SPLICES—Solderless screw lug connectors on all terminals, makes it possible by skinning leads back one half inch, to make connections with screw driver only.

NO JUNCTION BOX REQUIRED— Holes are provided on side of tank to accommodate conduit. Saves time, space and expense.

CONNECTION DIAGRAM—Is provided on inside of transformer cover showing all possible connections.

TANK CONSTRUCTION — Sturdy pressed steel drip proof construction throughout—louvers provide ample cooling—life-time finish of durable Gregory Green enamel assure pleasing appearance and complete protection.

STANDARD SIZES IN STOCK FOR IMMEDIATE DELIVERY—I to 100 KVA VOLTAGE 230/460 to 115/230, 575 to 115/230, 2400 to 120/240/480 Single phase 60 cycle. 10 KVA transformer and below have attached provisions for wall mounting. 15 KVA and larger are designed for floor or platform mounting.



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cil and Minnesota Association of Architects in the relationship between Architects, Engineers and Electrical Contractors.

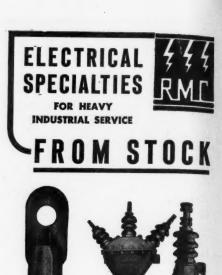
1. Separation of Contracts—Promote separation of contracts; that is, to have electrical contracts awarded separately on construction projects, because installation of electrical equipment is constantly growing more extensive and complex and less related to actual construction work or supervision of others. It is recognized that there are cases where it is desirable to combine all phases of a job under one general contract, in which case separate mechanical bids will be called for and awards made before a general contract is executed.

2. Include All Electrical Controls—Have all electrical equipment and controls, which are not an inherent part of other equipment or specialized heating or air conditioning controls specified as part of the electrical contract. Electrical contractors are usually held responsible for the satisfactory installation and operation of all electrically operated equipment, therefore they should also supply as much of that equipment as possible to promote undivided responsibility.

It is recommended that a joint effort be made to have manufacturers' guarantee on electrical products cover both the replacement of defective parts and the necessary labor involved in meeting required performance guarantees when such defects or causes for replacement



M. F. Cody, Board of Education New York City, and representative on the Executive Council, Eastern Section IAEI, led early morning discussions on the Code at the Section's 21st annual meeting.



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New president of the Western Section, I.A.E.I., George C. Monroe, Springfield, Mo., addresses the closing session of the recent Western Section conference in Chicago.

are clearly determined to be the manufacturers fault. Also recommended that joint effort be made to have installation diagrams and operating instructions accompany and be securely attached to electrical apparatus.

3. Keep "Or Equal" Clause—Oppose elimination of the "or equal" clause in electrical specifications, which may be often impractical and would prevent recommended changes by electrical contractors which might improve the job or result in justifiable savings. Wording to read "or equal approved"; contractors to submit suggested changes for the approval of architects, engineers and/or owners as the case may be.

4. Include Equipment in Specifications—Transformers, switchgear, capacitors and other heavy equipment which is a basic part of the complete electrical system to be specifically made a part of the electrical contract.

5. Furnish Approved Equipment—Back up architects and engineers to see that the grade and type of material specified or approved is actually furnished and properly installed. Electrical Contractors Association to cooperate in arranging for impartial inspections in case of any dispute.

bulbs and tubes as well as fixtures—Lamp bulbs and tubes as well as fixtures to be included in electrical contracts whenever new fixtures are to be installed as a part of any complete building project.

7. Selection of Contractors—Urge reasonable pre-selection by architect or engineer and owner of qualified contractors who are called on for bids on all private projects. It is suggested that three bidders on smaller jobs, five or six on larger jobs be construed as a reasonable number of bidders.

8. Painting Electrical Work-Painting





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Blo-Fan is a combination fan and blower. It has the volume of a breeze fan plus the power of a blower.

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E. W. Budlong, wiring superintendent and electrical foreman for J. & H. Electric Company, Providence, R. I., ponders while considering the problem of adequate labor to carry out the big electrical construction and maintenance job ahead.

of electrical conduits, panels, doors or hoxes and other electrical equipment, except in transformer vaults and similar hazardous locations, to be done by painting contractors. Such work is properly a part of the painting contractors work and except in electrically hazardous locations is no part of the electrical contractors customary work.

The Minnesota Electrical Council is urging all its members to cooperate by observing all of the ethical points involved in their relations with architects, engineers and mutual clients.

Committee members representing the architects in the negotiations were Albert O. Larson and Oscar Lang, with W. H. Tusler, ex officio. Representatives of the Minnesota Electrical Council were A. W. Stroheimer, Minneapolis; George Miller, St. Paul; and William A. Ritt, Minneapolis. Art Clausen made the arrangements. The points agreed upon will be published in the Architects Official Bulletin.

NATIONAL ADEQUATE WIRING BUREAU APPOINTS MANAGER

P. E. McCaughey, recently released from the U. S. Army with the rank

of captain, has been named manager of the National Adequate Wiring Bureau. Prior to the war, Mr. McCaughey was formerly in charge of the St. Louis, Mo., A.W.B. where he successfully promoted the Certification plan.

DEHAAN PILOTS CHICAGO CCECA

Emil DeHaan, Service Electric Shop, is the new president of the Cook County Electrical Contractors Association in Chicago. DeHaan heads an organization of 80 electrical contractors, one of the largest independent contractor groups in the country. Other new officers announced at the Eighth Anniversary meeting of the association in December are: vice-president, George W. Reinke, George W. Reinke Electric Co.; secretary, Theodore Osberg, Riverside Electric Co., Riverside; treasurer, Joseph Kunst, Principle Electric Company.

Directors are: Roy Clausen, West Town Electric Co., Cicero; George Elmund, Elmhurst; Erwin Kaufmann, Kaufmann Electric Co.; Abe Sluis, Sluis Electric Co.; Joseph Spinar, Cable Electric Co.; Leo Witz, Continental Electrical Construction Co.; and Howard Zingraf, Square D Electric Company.



Discussing electrical inspection problems postwar at IAEI Eastern Section's Annual Meeting were (L to R): J. D. Lynett, Past President IAEI (1944-1945) and Superintendent, Electrical Bureau, N. Y. Board of Fire Underwriters; Wm. D. Walker, Vice President, IBEW, Philadelphia, Pa.; and Arthur L. Abbott, Engineering Dept., NEMA, New York City, and author of the National Electrical Code Hand-Book.



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New faces in electrical league work (L to R) Wm. G. Hills, managing director, Electric Institute of Washington, D. C. (succeeded Jack Bartlett); and E. S. Northup, National Adequate Wiring Bureau, New York City (succeeded Art Schanuel).

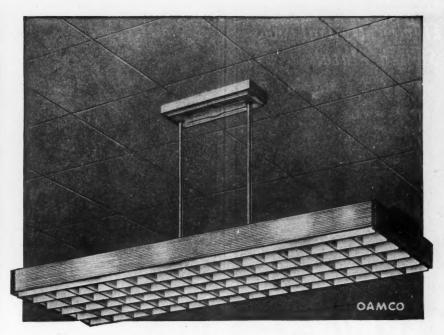
TRAINING COURSE FOR CAPITAL SALESMEN

The Electric Institute of Washington, association of the Capital's combined electrical industries, announces a yearround sales-training program beginning in February. Streamlined yet comprehensive in content, the program will be geared for both rookies and "old timers" of electrical sales forces and will combine featured lectures with open discussions, demonstrations of technique and the distribution of printed matter treating approach and sales promotion. Robert F. Mook, formerly with the Commonwealth Edison Company of Chicago, serves the Institute as Sales Training Director.

KASKA HEADS CHICAGO EMSA

Robert C. Kaska, Chicago Electric Company, was elected president of the Electric Motor and Service Association, Chicago, at the December meeting of that group. Other members elected to office to guide the activities of this Central District Chapter of NISA are; vice-president, J. G. Lessel, Central Motor and Repair Co.; secretary, H. P. Lehman, Lehman Electric Co.; treasurer, J. J. Smat, Queen City Electric Co.

Directors elected for a one year term are: Garrett Lea, Lea Electrical Equipment Co.; E. J. Ther, Ther Electric & Machine Co. Present Board members serving unexpired terms are Charles Kaska, P. J. Maher, P. M. Sievert, and Arthur Wagner, Sr.



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FOR RIGHT WORK LIGHT

The new OAMCO Egg Craté Louver Commercial Fluorescent Fixtures are designed and constructed to give high intensity illumination in stores, offices, drafting rooms and general working areas where maximum light plus fixture beauty are essential. These All-Steel Fluorescent Commercials have a welded steel louver finished in reflector white, side panels of diffusing ribbed glass and satin aluminum finished and covers, canopies and stems. The above units are furnished in the four 40-watt size for suspension or ceiling mounting and come completely wired including lamp holders, starters and high power factor ballasts.

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 Ends fumbling for switches in the dark!
- —Ends fumbling for switches in the dark!
 —Provides a "safety" glow, helps you avoid stumbling!
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 Lasts for years without a burnout!

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- Backed by an unconditional renewal guarantee!

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Frank Wolf of the newly organized Nebraska-Iowa Electrical Council, Omaha, gets a few pointers on electric association activities from W. A. Ritt (right), secretary-manager, Minnesota Electrical Council, Inc., Minneapolis.

LIGHTING EXPOSITION SCHEDULED FOR APRIL

The dates of April 25 to 30 have been set for the NEMA sponsored International Lighting Exposition. Exhibits will be set up at the Stevens Hotel in Chicago. The program will incorporate a series of conferences beamed for contractors, utilities, wholesalers, distributors and architects towards the latest progress, treatments, trends and future possibilities in lighting. Industry leaders are scheduled to head discussions on equipment; use of light and color to improve plant lighting; new ideas for stores, schools and offices; sales training and related topics. Official programs are now on the press and may be obtained by writing the International Lighting Exposition, 111 W. Jackson Blvd., Chicago, Ill.

DAVID E. HARRIS RECEIVES COOPERATION MEDAL

David E. Harris, Vice President, General Electric Supply Corporation, San Francisco, Calif., has been awarded the 1945 Medal for Cooperation given under the James H. McGraw Award. The presentation was made at an industry dinner in San Francisco on December 28 by George C. Tenney, representing Mr. McGraw and the Committee of Awards. The award carried the following citation:

"Some men in an inspired moment conceive a wholly unselfish activity from which as the result of collaboration great benefits

accrue to all branches of the electrical industry and then there are others like David Edward Harris who live a life of coopera-tion in the belief that the different interests that make up this industry are interdependent and that the bounties of good to one are shared by all. It is to such men that the industry with unerring instinct turns for guidance, for judgment and for friendly advice. Dave Harris, now vice president, General Electric Supply Corporation, San Francisco, has been a sparkplug of industry cooperation in California from his early days as a jobber's salesman. Whenever a cooperative program was initiated, whether by others or by himself, he has been one of its staunch supporters and earnest workers. His name will be found among the organizers of almost every important co-operative movement within the industry in California in the past quarter of a century. In 1918 he was one of the founders of the California Electrical Cooperative Campaign, the first statewide program of contractor-dealer and industry sales help and promo-tion in the west. It was this movement that launched the first "convenience out-let campaign," which might be said to be the forerunner of what is now the national campaign for adequate wiring. Out of this pioneer cooperative project came the California Electrical Bureau and the Pacific Coast Electrical Bureau, both of which he has served as chairman and continuously from their beginning as a member of the boards of directors. Likewise he has served without a break as a director of the allrindustry organization, the Pacific Coast Electrical Association. His was the task of guiding this body's Code and Ordinance Committee and Red Seal Adequate Wiring Committee, sometimes as chairman and always as a member. From the first committee came a uniform electrical code now widely accepted in the state and an unsafe appliance ordinance, adopted in 83 California cities and elsewhere in the West. So much has he identified himself with the

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Electrical Superintendent, J. H. Schad, has been handling construction jobs for the John O. Ledbetter Electric Co., prominent St. Louis electrical contractor for the past 12 years. And there will be a lot more in the future.

Electrical Contracting, January 1946



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H. H. Daniels, Chief Electrical Inspector of the District of Columbia, was elected Second Vice President of the Eastern Section, IAEI, at the Annual Meeting held October 22-24 in New York City.

common good of the industry that he is known among electrical contractor groups as a champion of fair play, one who would be a "friend in court" to present their views fairly to other wholesalers. For his contribution of never failing cooperation and constructive service to the electrical industry for more than 40 years, the Committee of Awards, upon recommendation of the judges, have awarded David E. Harris the 1945 Medal for Cooperation and Purse, given under the James H. McGraw Award."

The judges who selected Mr. Harris for this honor were W. J. Kranzer, Crannell, Nugent and Kranzer, New York, N. Y.; N. J. MacDonald, Vice President, Thomas and Betts Company, Elizabeth, N. J.; H. L. Miller, Utilities Engineering Co., Philadelphia, Penn.; L. A. Scofield, General Sales Manager, Consolidated Edison Company of New York, Inc., N. Y., and S. B. Williams, Editor of Electrical World for the Committee of Awards.

NECA PROTESTS REA DISCRIMINATION

An article under this same title appeared on page 206 of our December issue. The conclusion was omitted from the last edition so, with apologies, we summarize and continue.

Resume: Officials of NECA state that congressional action will be instigated unless the REA ceases its present so-called policy of blacklisting aimed at electrical contractors simultaneously bidding on co-op construction jobs and performing work for privately owned utilities. NECA's general council, O. R.



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Sports and area, sheet aluminum 750 to 1500 watts, Type L-68	GEA-4333
Area, open porcelain enamel 300 to 1500 watts (Type L-45) (Type L-46)	GEA-4433 GEA-4432
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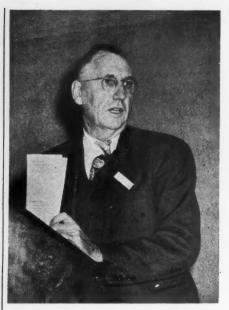
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Luke R. Storey, new president of the Rocky Mountain Electrical League, is vice president of the Home Gas & Electric Company at Greeley, Colo.

McGuire claims discrimination although REA Administrator, Claude Wickard, defends the policy as being in the interest of rural electrification projects.

Mr. Wickard affirms that the "policy is not based on any tendency to attribute to contractors the 'shortcomings' of the utilities which employ them but is dictated purely by considerations of selfprotection which years of experience have shown to be necessary." He outines the agency's experience with private companies which serve only selected customers in a rural area and thus render it difficult if not impossible to serve the remainder on a paying basis. Contractors have a single pool of materials and should not be expected to serve the interests of competitive customers from them. He adds "Since the contractor should look after his best customer first, and since the utility is usually the best customer by reason of its larger size, the interests of the REA co-operatives are more than likely to suffer under these circumstances." Mr. Wickard suggested that NECA send a committee to the REA headquarters to straighten out the difficulty but a memorandum from him to Agriculture Secretary Clinton P. Anderson, dated several days after his suggestion of a meeting, indicated his intention of continuing the policy. On the basis that the memorandum implied pre-determination and insincerity on the part of Mr. Wickard, NECA refused to comply with the invitation.

Continuing the December article at the point of interruption:

In the case advanced by McGuire as indicative of REA "chiseling," only two of the 24 contractors bid on a job advertised by the Coles-Moultrie Electric

Co-op of Mattoon, Ill. The \$1,102 per mile figure of the low bidder, Contracting and Material Company, was rejected as too high. Wickard asserted that the project was then re-advertised with a resulting bid of \$1,079 per mile, a saving of \$23 a mile, by E. A. Koeneman and Company, which was accepted. He said McGuire was wrong in asserting that in this case, a new bid was negotiated after first bids had been opened and rejected. In his reply to Wickard, McGuire said that representatives of the low bidder informed him that the co-op, "inspired by REA," had asked the low bidder to enter negotiations aimed at reducing the bid price, and that only after the request was refused was there any re-advertise-

In replying to Wickard's memorandum, McGuire pointed out that despite his hard words for private utilities, Wickard had said nothing against any electrical contractor. He pointed out that REA and its co-ops are not spending private funds but are spending tax monies, and argued that they should be spent as other tax monies are-on contracts let to the lowest responsible bidder. He charged that it is a deviation from the letter of the REA act to allow rural electrification loans to be made for the bringing of service to unserved rural customers in other than the cheapest possible manner. This violation, he said, arises from refusal to accept the lowest responsible bid or to bar contractors from bidding who might be low. He ridiculed the idea that a confidential relationship must exist between contractor and co-op, and declared that "I find nothing in the law which contemplates that one shall stalk the other."



Carl Christine, St. Louis Electrical Board of Trade (left) listens to George W. Austen, manager, Electric Service League, Toronto, Canada, tell of his impending plans to retire.

Striking at the "chiseling" he found in the negotiation of contracts after bids have been opened, McGuire said such activity leads contractors to bid higher than they otherwise would so as to have a margin left for the inevitable negotiation, and declared:

"The fact that futile attempts to chisel and readvertising resulted in the small saving of \$23 a mile in the cited case does not mean that a larger saving might not have resulted in the first low bid had bidders known in advance that the lowest competitive bid by a qualified contractor would have been accepted."

U. L. ENGINEER RETIRES

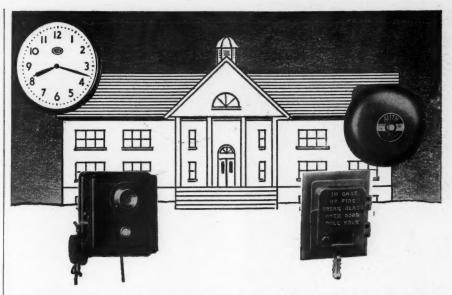
In accordance with the Underwriters' Laboratories, Inc., retirement plan, Earl J. Smith relinquished his responsibilities as engineer of gases and oils at the Chicago headquarters on Dec. 31, 1945. Mr. Smith completed more than 39 years of continuous service, coming to the Laboratories in June, 1906 as a graduate of the course in Fire Protection Engineering at Armour Institute of Technology.

Starting as a tester of hand fire extinguishers, he subsequently took over the testing of gasoline stoves and lighting systems, acetylene generators for lighting and early models of gasoline storage and dispensing units. His responsibilities extend to cover the comprehensive list of products now catalogued in the List of Inspected Gas, Oil and Miscellaneous Equipment published by the Laboratories.

During his long-time service, Mr. Smith gained prominent recognition as an outstanding authority on problems of



Some highlights on the future of television are given IAEL delegates at Chicago conference by Seymour Mintz, director of advertising, Admiral Corporation, Chicago.



SELECT AUTH FOR SCHOOLS

and put
50 years
of experience
into the job

Auth signaling devices for schools embody all the quality of detail and efficiency of service that a half a century of experience in signaling devices can teach.

Add that to your own experience and you're sure of a job you can stake your reputation on.

Complete Auth dismissal bell systems with Telechron-motored program clocks, in conjunction with attractively toned bells, chimes, buzzers, horns and gongs gives you a wide choice for class-rooms, corridors, offices, yards, etc.

Auth intercom phone systems—the systems that are noted for simplicity—are available with any popular type of instrument for non-selective or selective talking. Secretarial instruction switchboards if desired.

Auth dependable fire alarms are available to meet your state regulations for schools. See the complete Auth catalog for many other specialties.

Hundreds of modern schools are completely Auth-ized. Experienced Auth engineers will gladly offer any suggestions or designs you wish. Just write us or contact the Auth representative near you.

Ask for Telephone Bulletin 85, Bell-Buzzer Bulletin 35, Fire Alarm Bulletin 70





• Back on a peace basis once more! That means the Aerovox line of motor-starting capacitors once again includes the widest selection of both exact-duplicates and those universal types that served so well during the war shortage. You can now get replacements exactly matching the units you're replacing—even to such details as the insulating jacket, as here shown. Yes, be sure to make it AEROVOX for those replacements—and you'll be getting just the right types for the right jobs.

Ask Your Jobber . . .

Ask him for AEROVOX motor-starting capacitors. He either has them or can get them for you. Ask for the latest Aerovox Catalog. Or write us direct.



AEROVOX CORP., NEW BEDFORD, MASS., U.S.A. Export: 13 E. 40th St., New York 16, N.Y. - Cable: 'ARLAB' in Canada: AEROVOX CANADA LTD., Hamilton, Ont.



At the recent IAEL conference in Chicago were (L to R) A. L. Maillard, new manager of the Electric League of Indianapolis, Inc.; R. T. King, Central Jersey Electric League, Trenton; and J. J. Dore of the new Nebraska-Iowa Electrical Council, Omaha.

safeguarding equipment and methods involving basically hazardous materials. He has announced no pians for the future.

POSSIBILITIES OF ATOMIC POWER

An attempt to set atomic power into its proper place in the engineering world is about as difficult as a prophecy of the future of electricity might have been at the time of the first electric lamp according to L. W. Chubb, Director, Research Laboratories, Westinghouse Electric Corp. Only more so. Generation and production of electric power were allowed to follow a natural course as dictated by engineering developments and economics. But superimposed on the technical developments of atomic power will be political and military controls, the extent and effects of which are still undetermined. In appraising the technical and economic possibilities of atomic power, however, a few facts stand out clearly.

1. Atomic power is an actuality. The atomic-energy piles at Hanford, Washington, are continuously delivering several hundred thousand kilowatts of thermal energy, enough to raise sensibly the temperature of the Columbia River.

2. The cost of that energy, which is a byproduct, if known, has not been made public. It would seem, however, that it must be high, probably many times that of other fuels. The costs of preparing sufficient purified uranium for practical piles are likely quite high. Furthermore, complete "burning" of a prepared lump

of uranium is not possible. Just as ash accumulates around a chunk of burning coke, which tends to slow down or stop the combustion, so the nuclear processes produce substances that retard the reaction. In a relatively short time the "poisoning" reaches such a degree that a complete and expensive refining operation must be performed or the uranium discarded.

3. Controllable atomic-energy generators of smaller size and weight are possible now. However as the size comes down the richness of the fissionable material must be increased. Costs rise astronomically with degree of enrichment.

4. The fission products are strongly radioactive for periods varying from seconds to years. Radiations from the power source are extremely hazardous to any form of life. Protective measures require thick barriers of appropriate materials. The bulk and weight of safety devices for small power plants would far exceed that of the pile itself.

5. Fission is now accomplished with uranium isotopes, and plutonium which is derived from uranium. The amount of uranium ore and its distribution over the earth, if known, has not generally been disclosed.

6. Nuclear reactions to achieve energy release with other elements is theoretically possible and may be practical although no announcement of such has been made. Thorium is one possibility. It should be remembered that heat is available either by fission of heavy atoms into elements near the middle of the atomic scale, or by synthesis of lightweight elements into higher ones. Heat from the sun is thought to be energy re-



Located in Frederick, Md., F. Homer Miller, owner and manager of Modern Lighting Company combines electrical contracting with appliance sales and service. This combination, says Homer, has kept him busy through good times and depression years since 1917, when the business was organized.



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George Kravel, building cable engineer, Michigan Bell Telephone Co., Detroit, is brought up to date on plans of the Electric Association of Detroit, by Colin G. Odell, manager of the organization.

leased from the combination of hydrogen atoms with helium atoms by successive nuclear reactions.

7. Atomic power almost assuredly will become a practical power source, likely apparent application is for ship propulsion, or large power and heating plants using atomic fuel. Small-size power plants for private vehicles appear impractical. Above all—aside from governmental controls—the laws of economics will apply.

These practical difficulties, large though they be, should not obscure the fact that atomic power presents to the technical man enormous, fascinating opportunities and to the average citizen the greatest force of all time, for good or evil as he sees fit to use it.

MENTZER IS RMEL FIELD REPRESENTATIVE

Meryl E. Mentzer, who joined the staff of the Rocky Mountain Electrical League on November 16, 1945, was recently appointed field representative of that organization. Working out of the League headquarters in Denver, Colo., he will devote a major portion of his time to the newly organized adequate wiring program.

Mr. Mentzer brings to the organization an excellent background of technical experience. He is a former electrical contractor, having been associated with his father in Des Moines, Iowa. Before joining RMEL, he completed two years of work as supervisor of inspectors for the U. S. Navy, with headquarters at Denver.

THE NEWEST DEVELOPMENT OF THE NEWEST DEVELOPMENT OF THE NEWEST DEVELOPMENT OF THE NEW STREET OF THE NE

Circuit Breaker Load Centers.

OUR customers want to be rid of the fuss and bother of changing fuses in their post-war homes. Now, for the first time, you can offer them greater convenience and lifetime circuit protection with Kinney "Quicklag" Circuit Breaker Load Centers.

Here's a brand new device—nothing else on the market compares with it—and it gives your customers "Quicklag's" superiority over ordinary circuit breaker load centers. "Quicklag" breakers won't trip on momentary overloads, yet give absolute protection against short circuits or prolonged overloads. Thus no needless re-setting, no fuse fumbling. "Quicklag" breakers are built for lifetime reliability, yet the cost of Kinney "Quicklag" Load Centers is surprisingly low.

Cash in on the coming building boom, and sell Kinney "Quicklag" load centers. They are available in 2, 3, 4, 5, 6, 8, 10, 12, 14 and 16 circuit sizes, with 15 to 50 ampere breakers. Write NOW for the attractive Kinney catalog which includes "Quicklag" load centers, and get the facts.

REMIND YOUR WHOLESALER TO STOCK UP ON KINNEY "QUICKLAG" LOAD CENTERS TO BE READY FOR THE BIG BUILDING BOOM.







Chief inspectors Carl L. Ramsby, Goshen, Indiana; and J. H. Cannon, Tulsa, Oklahoma, enforce electrical safety regulations in their respective cities. Both attended recent Western Section, I.A.E.I. conference in Chicago.

APPLIED LIGHTING

A comprehensive ten-session course on "Applied Lighting," jointly sponsored by the New York sections of the IES and AIEE, is attracting an enthusiastic group of illuminating engineers, architects, and consulting engineers, contractors, utility men, jobbers and students. Twenty-one authoritative speakers are key-noting the sessions and leading the forum discussions. An indication of the wide scope is suggested by the selected titles slated for attention: Prescribed Illumination (applying theory to practice); Industrial Lighting; Outdoor Lighting (from garden to sports arena); Residential Lighting; Commercial Lighting; Lighting of Public Buildings; Lighting for Aviation (Latest war-born techniques and future trends); Lighting for Stage and Theatre; Wiring Problems, Regulations and Fittings (Codes and Construction) and Lighting Associations (Association of structures to esthetics; lighting to air conditioning and acoustics; illumination to color treatments). Each meeting will begin with a brief resume of fundamental principles; then discussions of latest theory, applications, trends and possibilities.

CENTENNIAL TO HONOR INVENTOR OF LIGHT

February 11, 1947, will mark the 100th anniversary of the late Thomas A. Edison's birth. International observances in honor of this great American will be arranged by the Thomas A. Edison Centennial Committee under the chairmanship of Charles F. Kettering, Vice President of General Motors Corpora-

tion in charge of research, President of the American Association for the Advancement of Science and Chairman of the National Inventors Council. Henry Ford, long a close associate of the inventor, will serve as chairman of an Honorary Committee which will include members of the Edison family; Mrs. Mina Miller Edison, the inventor's widow; Mrs. John E. Sloane, his daughter; and former Governor Charles Edison of New Jersey, his son.

ELECTRIC CIRCUITS AND MACHINES

A comprehensive treatment of electric circuits and machinery, including the fundamentals of both direct and alternating currents, is given in a new book, "Electric Circuits and Machines," by Eugene C. Lister. Forming an introduction to practical electricity, the discussion is made easily understandable by placing emphasis on the physical action that occurs, rather than on a detailed analysis of the theory involved.

Mathematical discussions are left out as far as practicable, and limited largely to simple algebra. Many numerical examples are worked out in detail, and a list of problems is included in those chapters where the solution of problems will illustrate the application of the principles involved. The material presented will prove to be suitable for students with varied educational backgrounds, and for courses with varied objectives.

The structure of matter, electron theory and electric current are discussed in the first chapter on fundamental units, embracing the ampere, ohm, volt, measurements and wire gauges. Direct current circuits are discussed in detail in the second chapter, as well as Ohm's law, Kirchoff's law, line drop, electrical work and energy, measurement, and other related subjects.

One chapter is devoted to primary and secondary batteries, and various types of batteries. The theory, construction, care and maintenance are described and discussed. Other chapters relate in detail to magnetism, electromagnetic induction, direct current generators, direct current motors and controls, alternating current, single and three phase circuits, transformers, alternators, polyphase induction motors, synchronous motors and self-synchronous apparatus, single phase motors, instruments and measurements, and electronic tubes. In the appendix are solid and stranded wire tables, wiring diagram symbols, a table of full-load currents of motors, trigonometric definitions and formulas, and a table of trignonometric functions.

This book is fully and simply illus-

NAME-

COMPANY-

ADDRESS.

trated, contains 358 pages, and is 5½ by 8¾ inches in size. Its author, Eugene C. Lister, was formerly supervisor of Electrical Theory Instruction, Specialized Training Program, Iowa State College, 1942-1944, and is now with the Stanley Engineering Company. The book is published by McGraw-Hill Book Company, 330 West 42nd Street, New York, 18, New York. Its price is \$3.50.

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DATES AHEAD

Illuminating Engineering Society—East Central Regional Lighting Conference—Philadelphia, Pa., January 31-February 1.

National Association of Home Builders— Convention and Exposition—Steyens Hotel, Chicago, Ill., February 25–28.

Refrigeration Equipment Manufacturers
Association, Hotel Stevens, Chicago, Ill.,
March 4-7.

North Central Electrical Industries—First Postwar combined electrical industry convention and trade exposition—Radisson Hotel, Minneapolis, Minn., March 10-14.

Midwest Power Conference—Palmer House, Chicago, Ill., April 3-5.

National Electrical Manufacturers Association—Spring Meeting—Palmer House, Chicago, Ill., April 8.

National Industrial Service Association— National Convention—Tampa, Fla., April 8-10.

American Society of Tool Engineers—Fifth Annual Exposition—Public Auditorium, Cleveland, Ohio, April 8-12.

National Electrical Wholesalers Association—37th Annual Convention—Stevens Hotel, Chicago, Ill., April 21–25.

International Lighting Exposition, NEMA—Stevens Hotel, Chicago, Ill., April 25-30.

Housewares Show — National Exhibition — Convention Hall, Atlantic City, N. J., May 13-17.

"Products of Tomorrow Exposition"—Chicago Coliseum, Chicago, Ill., April 27—May 18.

National Electrical Manufacturers Association—The Homestead, Hot Springs, Va., June 17-19.

Southern California Construction Industries
—Exhibition and Home Show—Pan-Pacific
Auditorium, Los Angeles, Cal., July 12-21.

Illuminating Engineering Society—National Convention—Chateau Frontenac, Quebec, Canada, September 18-21.

MANUFACTURERS NEWS ____

AMERICAN TRANSFORMER MAKES PROMOTIONS

American Transformer Co., Newark N. J., announces the appointment of Walter Garlick, Jr. as vice president in charge of sales and related activities. A. A. Emlen has been appointed vice president in charge of engineering. W. R. Smith, works manager, relieves Mr. Emlen of all supervision and responsibility in connection with factory operations.



Fluorescent Lamp Ballasts

• Operating quietly and efficiently, building up untold hours of completely satisfactory service in countless industrial and commercial fluorescent lighting installations, Chicago Transformer ballasts have established a reputation for reliability and quality during the past demanding years when unfailing service was all important.

Engineered for constant performance and constructed for years of hard use, the inherent quality of Chicago Transformer ballasts assures the long, cool, quiet operation so necessary for dependable fluorescent lighting.

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110-Volts A.C. from Direct Current

with KATOLIGHT ROTARY KON-VERTERS Change 32, 110 or 220 volts D.C. to standard 110-volt, 60-cycle A.C. for operating radios, electronic & sound apparatus, electric signs, A.C. appliances, etc.



KATO ROTARY KONVERTER, 225 Watts Pioneers in the Building of Small Rotary Converters

Special motors and generators 25 to 800 cycles.

Also manufacturers of A.C. and D.C. generators ranging from 350 watts through 25 K.W.; power plants; Frequency Changers; and Motor Generator Sets.

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MULTI Fluorescent Reflectors give you the modern method for taking care of industrial and residential installations. Our complete line contains the proper unit for any and all needs.

Send for our complete catalog

MULTI

ELECTRICAL MANUFACTURING CO. 4223 W. Lake St., CHICAGO, ILL.

SYLVANIA ACQUIRES WABASH

The Wabash Appliance Corp. has merged with the Wabash Photolamp Corp. and Birdseye Electric Corp. to become a wholly-owned yet independently operated subsidiary of Sylvania Electric Products Inc. A. M. Parker remains as president and general manager of Wabash, with headquarters at Brooklyn, N. Y.

E. Finley Carter, formerly vice president in charge of industrial relations, has been named vice president in charge of engineering. Howard L. Richardson succeeds Mr. Carter as director of industrial relations. He was formerly manager of Personnel Administration.

WESTON PLACES SALES Under Harold L. Olesen

The appointment of Harold L. Olesen as general sales manager of the Weston Electrical Instrument Corp., Newark, N. J., has been announced. He succeeds H. L. Gerstenberger who will continue as vice president in charge of sales. Mr. Olesen is a graduate electrical engineer of the University of Illinois and has had a comprehensive experience with the



HAROLD L. OLESEN

signal corps in the first world war; as a research engineer for the original RCA and as an electrical engineer for Fansteel Products and Jewell Electrical Instruments. Mr. Olesen has been with Weston since 1931 in the capacity of radio and general sales management and promotion. During the war he acted as a consultant for the WPB and was also Chairman of NEMA's Priorities and Materials Allocation Committee.

CHANGES IN WAGNER BRANCH PERSONNEL

Wagner Electric Corp., St. Louis, Mo., announces the following changes in their service branch personnel: Forrest G. Wilson, a former Dallas salesman, has been appointed manager of the

Indianapolis branch; H. F. Zahn, former manager at Atlanta, assumes the equivalent position at Philadelphia; C. G. Jackson transfers his managerial attentions from Boston to Atlanta, and J. K. Miller will manage the Boston office, moving to this new branch from the New York sales office.

W. J. GOERISCH HEADS GRAYBAR LAMP SALES

William J. Goerisch has been appointed sales manager of the Graybar Electric Company's New York lamp department, Mr. Goerisch has been associated with Graybar since 1929 and has been working



W. J. GOERISCH

with lamps and lighting since 1931. A graduate of Washington University in St. Louis, he has served as IES chairman of that city's chapter.

NEW MANAGERS FOR ALLIS-CHALMERS

J. K. Keogh, with over 40 years of service with the Allis-Chalmers Mfg. Co., has been appointed manager of the Pittsburgh district office.

The Duluth, Minn., sales office is now directed by John G. Barta, formerly located in the Milwaukee district. Mr. Barta's new position was formerly filled by William H. Knight who resigned after 36 years with the company.

WESTINGHOUSE ANNOUNCES FOUR NEW MANAGERS

Lt. Col. George B. Mackey, air veteran of two wars, returns from military service to the Bloomfield, N. J., plant where he will manage the newly-established miniature lamp sales and promotion department. Col. Mackey has been associated with Westinghouse since 1922 and was syndicate manager of the Bloomfield branch at the time he re-entered the Army air corps in 1942.

H. Norman Miller, newly appointed

manager of the company's Portland, Oregon, activities has had 19 years in that area as a member of the Westinghouse industrial sales staff. He succeeds L. G. Fear who will now act as the company's special coordinator for the Pacific northwest and Alaska.

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At the main East Pittsburgh, Pa., plant the aviation section has been transferred from industrial to marine sales; the new Marine and Aviation Sales department being headed by C. H. Weaver who has managed marine sales for the past two years. The aviation section of the new department will be managed by A. L. Paquette who has been responsible for aviation sales in the eastern district for six years.

RCA VICTOR ANNOUNCES FIVE VICE PRESIDENTS

RCA Victor has promoted five executives to vice presidencies. The new officers were formerly general managers of the commercial activities they now head as vice presidents. The new officials are L. W. Teegarden, RCA Tubes;



L. W. TEEGARDEN

Meade Brunet, engineering products; J. B. Elliott, home instruments; Jos. H. McConnel, general attorney of RCA Victor; and J. W. Murray, RCA Victor records. The head of each of these activities is directly responsible for engineering, manufacturing, purchasing and selling.

NEW SALES APPOINTMENTS BY ESSEX WIRE

V. A. Hedlund is now in charge of Chicago sales of R-B-M products for the Essex Wire Corp., 411 S. Peoria St., Chicago. A graduate EE from Armour Institute of Technology, he has had 10 years experience as a sales engineer in the Chicago area.

H. A. Jules, sales representative, has been transferred to the Newark, N. J., office located at 457 Frelinghuysen Ave. and will cover the eastern seaboard from Boston to Baltimore, including southern

New York and eastern Pa.



INFRA-RED RAY

DRYING . BAKING . DEHYDRATING



Radiant Energy, The Modern Method Cuts Drying Cost, Saves Time, Uses Minimum Space, Produces Uniform Results with

NALCO CARBON Lamps



Use Nalco Dritherm Lamps for efficient results . . . available in Inside-Silvered (self-reflecting) or clear glass types.

Learn all of the advantages of the Infra-Red Process— Write for your free copy of "Drying Problems Made Easy" today.

Illustrated a fivelight portable adjustable Nalco Unit with gold-plated Reflect-

NORTH AMERICAN ELECTRIC LAMP CO.

1044 Tyler St. St. Louis 6, Missouri



Major Theodore C. Ohart returns to the Empire Sales District of the Lamp Dept., General Electric Co. at Buffalo, N. Y. as district manager. He has had five years service in Army ordnance work.

A. R. Sorenson has been named Pittsburgh general manager for Radio Sound Corp. and will be responsible for Lear Home Radios in that territory. Mr. Sorenson previously served with Westinghouse, Frigidaire and West Penn Power.

Construction is in progress on a modern unit for the Acme Electric and Mfg. Co. of Cuba, N. Y. The new steel, brick and glass building will double present transformer manufacturing facilities.

Ludlow King has been appointed manager of the Washington, D. C. office of Owens-Corning Fiberglas Corp., 1031 Investment Building. Mr. King recently retired as a lieutenant colonel from the Chemical Warfare Service in which he was executive officer of the Materiel Command. Mr. King succeeds C. R. Donovan who has established his own firm as a Washington business consultant. Mr. Donovan has represented NEMA in Washington for two years and also served in the Department of Labor and with NRA for four years.

The New England sales office of the National Electric Products Corp., Pittsburgh, has been transferred from 137 Kneeland St., Boston, to 270 Albany St., Cambridge, Mass. Wallace A. Card manages this new office.

Simplex Wire and Cable Co. announces the appointments of Arthur W. Coombs as New England Sales Manager and Edward F. Galvin as manager of railroad sales.

Richard P. Ballou, has been appointed chief engineer of Federal Electric Products, Newark, N. J. Having received an EE degree from Iowa State College, he successively served Donegan Electric, Westinghouse, Union Switch and Signal, Allen Bradley, Colt's Fire Arms and the Raytheon Manufacturing Companies.

Roy J. Thompson has been added to the engineering section of the Miller Co. of Meriden, Conn. He will serve as commercial engineer. Mr. Thompson is a graduate electrical engineer with 15 yrs. of practical experience with lighting. He has served as lighting specialist with the General Electric Supply Corp. in Oklahoma City, as electrical engineer with the Austin Co. and as radar design engineer with the Navy.

Nelson R. Zicherman has joined Globe Lighting Products Co., Brooklyn, N. Y. as purchasing agent for the company's materials and equipment. For 12 years Mr. Zicherman held an administrative position with the U. S. Department of Justice.

The Electro Mfg. Co., Chicago, has purchased the G. E. Lamp department's business in rectified fluorescent and Cooper-Hewitt fixtures. G. R. Clover, with past experience in both the Cooper-Hewitt and G. E. organizations joins Electro in an executive capacity to supervise sales operations of this new business.

Robert C. Allen, Jr. returns to the General Controls Co., Glendale, Cal., from three and one half years af electrical work with a Marauder bomber squadron of the 9th Air Force. Mr. Allen assumes the managership of the Kansas City, Mo. factory branch.

Associated Research, Inc., Chicago, has appointed L. G. Snyder as sales manager in charge of sales and advertising.

The General Electric Credit Corp. has opened a new Brooklyn office in the Chamber of Commerce Building and E. Ostrander has been appointed manager.

Campbell and George Co., 379 Brannon St., San Francisco 7, Cal., has been appointed to handle the Allen-Bradley line of electrical controls in northern Cal.

Bright Light Reflector Co., Inc. announces the location of their new office and plant at Fairfield and State, Bridgeport 5, Conn.

Lighting Techniques For Food Stores

[FROM PAGE 60]

tures, can be highlighted so that the customer or clerk can quickly and easily find any item desired. A suitable unit for this purpose is shown as part of the general lighting trough illustrated in Fig. 3-A. The fluorescent louvered unit shown in Fig. 5-C or the incandescent lens unit shown in Fig. 5-D, can also be installed in the ceiling parallel with the wall, at proper distance from the wall to light the case uniformly. Either of these might be used to highlight the wall cases when any of the types shown in Figs. 3-B, -C, -D, -E or -F, or Figs. 5-A or -B are used for general lighting.

Luminous Signs

Luminous signs are important in today's food store, especially the "serveyourself" type. They identify the various departments quickly for the customers, and save time for both the customer and clerks. Illuminated signs may be of several types. Opaque letters are used on luminous backgrounds, and luminous letters are used on opaque backgrounds. The letters may be painted on an opaque background in contrasting color and light projected on it. An effective new type luminous letter sign uses clear plastic letters which are illuminated by a colored fluorescent lamp concealed in a housing behind the sign face. The letters take on the same color as that of the lamp used. Another new type sign uses fluorescent plastic letters, available in different colors, which are activated with ultraviolet radiation from a fluorescent lamp equipped with a black light filter.

Germicidal Irradiation

Germicidal lamps, in suitable types of equipment, can be used in many ways in food stores. Installed in the general sales area, they disinfect the air and reduce odors, an important contribution to improved public health. In meat cases and storage coolers, energy from germicidal lamps can be used to destroy the bacteria and mold spores in the air and on the meat surfaces, which cause spoilage. Leafy vegetables, fruits and other produce can be protected from the spread of slime and mold contamination, when properly irradiated.

The use of germicidal energy in irradiating air or surfaces should be discussed with qualified representatives of lamp and equipment manufacturers, since this radiation is harmful to eyes or bare skin, under direct exposure.

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McGraw-Hill Mailing Lists, used by leading manufacturers and industrial service organizations, direct your advertising and sales promotional efforts to key purchasing power. They offer thorough horizontal and vertical coverage of major markets, including new personnel and plants. Selections may be made to fit your own special requirements.

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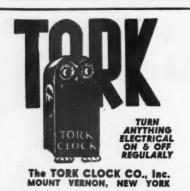
330 West 42nd Street

New York, 18, N. Y.

WHERE TO BUY

Equipment, Materials and Supplies for

Electrical Construction — Maintenance — Repairs





FLUX for Sodering Silver Sodering, Welding L. B. ALLEN CO., INC. 6715 Bryn Mawr Chicago, 31, III.

DRILL CONCRETE THE EASY WAY



Saves time and labor installing expansion anchors, Two motions—reciprocal for hammer drilling—re-tary for twist drilling. Drills masonry to 13/6", dia., metal 3/6". Easy to maintain. Universal motor, runs direct from lamp socket. Weighs 15 lbs. Star drills in 17 diameters. Also chisels, bull points, etc. Ask for bulletin.

Wodack Electric Tool Corporation 4628 W. Huron St. Chicago 44, III.

Telephone Allstin 9866

Speed Reconversion with a A Puller Reel . . . A Fish need is pushed, pulled and unwound by sir and an handle. One stree A Fish Tape

Burned Out or Broken Electric Heating Elements



A GOOD

Habit

The Where-To-Buy Section of Electrical Contracting supplements other advertising in this issue with these additional announcements of products and materials of special interest and application in the field of electrical construction, maintenance and repair work. Make a habit of checking this page each issue -a good habit!

ANNUNCIATORS LAMP

Kirkland Bulls-I-Units are ideal for building lamp annunciators.

Just provide the proper size holes

i n t h e



panel, then insert the Kirkland units and lock into place. As-

assembly is then ready for installation. Connect incoming wires and

place in service.

With for Catalogue
THEH. R. KIRKLAND CO., MORRISTOW N.N.J.

Your Inquiries to Advertisers Will Have Special Value . . .

for you—the advertiser—and the publisher, if you mention this publication. Advertisers value highly this evidence of the publication you read. Satisfied advertisers enable the publisher to secure more advertisers and-more advertisers mean more information on more products or service-more

HOW MUCH WILL IT COST

[FROM PAGE 57]

- (c) channeling floors
- (d) multiple story buildings
- (e) adverse working conditions in general
- 3. Remote pushbutton controls
- 4. Starters and other special equipment to be furnished by the contractor.

Quick Motor-Horsepower Rule

At the bottom of the table (Note "2") appears a "rule of thumb" formula for quickly estimating branch circuit wiring (from power distribution panel to the motor) for motor installations. Developed by contractor A. C. McWilliams, McWilliams Electric Co., Inc., Chicago, after years of experience estimating and installing motor circuit work, the simple equation can be stated as follows:

Customer's Cost of Branch Circuit Wiring = \$50.00 per motor + \$5.00per horsepower of connected load.

For example:

The cost of branch circuit wiring for a 30 hp., 220-volt motor would be \$50.00 $+ (30 \times \$5.00) = \200.00 . The table unit for this motor is \$206.00.

In checking the results with this formula, against the individual motor units in the tables, it was found that in general the price was somewhat lower than the table units for 220-volt motors and somewhat higher than those shown for 440volt motors. Nevertheless, it is a good formula to remember for it serves as an excellent method for field estimating and checking.



Prominent midwestern illuminating engineers at recent I.E.S. Regional Conference at Davenport, Iowa were (L to R) C. N. Laupp, Wisconsin Electric Power Co., Milwaukee and J. A. Harrington, Commonwealth Edison Co., Chicago.

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in

- Sets the indicating controller at the higher or curing temperature of 500° F.
- 4. Sets the temperature change clock to the desired time that the high temperature bake is to start.

Figure 2 is a schematic wiring diagram of the entire control system of an electric oven. A gas fired oven has the same control characteristics. The oven control is energized by closing the control switch. When power is on the control transformer, all motors in clocks and temperature controllers will run continuously, maintaining correct time and recording oven temperature. When the control switch is closed, a green light indicates that power is on the oven.

At present time, the normally open contacts in the "on-off" clock close, thus energizing fan motor starter S through normally-closed overload relay contacts. If overload relay contacts open, oven will not start; or if operating, oven will shut down. Exhaust and recirculating fan operation will close normally-open contacts in air flow switch, energizing the purging timer. After five minutes purging time, with full oven ventilation, but without oven heat being turned on, purging timer normally-open contacts will close completing the circuit through the temperature change clock normallyclosed contacts and through the "low" contact of the low temperature controller to the oven contactor. An amber pilot light indicates that low temperature control is in operation.

When the temperature change clock, after present time, trips to "on" position, the normally-closed contacts in clock open, switching off the amber light and low temperature controller, and the normally-open contacts close, switching on the red pilot light and the high temperature controller. Simultaneously, through relay R, damper motor M turns the exhaust damper about two-thirds off, reducing the ventilation during the high temperature bake. Note that the damper motor recycles itself when the "on-off" time clock shuts the oven down at the end of the bake, and the travel limit switch, rigidly attached to the damper rod, insures a wide open damper and full ventilation for subsequent bakes. The recording controller records both high and low temperature cycles. In case of power failure, the oven shuts down and starts up again with resumption of power, purging itself automatically.







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Safety Factors in Arc Welding

[FROM PAGE 65]

operator will get hold of two welding circuits at once.

Probably the most important item in equipment, from the safety point of view, is the electrode holder.

An uninsulated electrode holder is an ideal set-up for trouble. The operator undoubtedly in contact with the conducting metal in a number of places on his body, unless his clothing is dry and his shoes free from nails. In his hand he holds an electrode holder which has a handle of insulating material, but through which extends an uninsulated screw-head. Probably any contact he might make with the screw, through wet gloves or with the bare hand, would be too small in area to permit electrocution. But a shock may make him do something involuntarily, which will put him in danger. The worst feature of this holder is that the head, projecting out beyond the ring or collar of insulating material just above the hand, is entirely uninsulated. Each time the operator changes welding electrodes, there is a good chance that he will contact this exposed metal. If he should fall on the holder, or sling the cable over his shoulder or around his neck, as is frequently done, this live conductor may contact his chest or back.

There are now several types of good insulated electrode holders on the market. They should be used on any welding job, and their insulation should be kept in first-class condition.

Maintenance and supervision play an important part in the safety side of welding, as is the case in almost any other process. Fire hazards should obviously be watched for and, when. found, eliminated. Welding cables and their connectors should be examined frequently for breaks in insulation. The extremely hard service to which welding cables are subjected often results in severe damage to the insulation. Yet the welding operator, accustomed to arcs and sparks in his daily work, often disregards accidental short circuits which spell trouble to the safety man or the fire inspector. Likewise, welding return circuit connections should be given attention, by supervision. Arcs or flashes in unexpected places along the return path of the welding current may result in fire hazards if reinforcing rods, scrap lengths of pipe or bar laid together, or building piping are indiscriminately used.

The maintenance of adequate safety

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ground connections to the frames of all welding machines should be checked, because many operators do not realize their importance. For the same reason, the maintenance of insulation on electrode holders should not be left to operators alone. Electrical repairs and connections on the power-line side of the welder should be handled only by competent men.

In the last analysis, it is obvious that the welding operator and his safety education plays the greatest part in preventing accidents to himself. It is undoubtedly significant that at least onethere are probably others-of the large electrical manufacturing concerns has an unusually good accident record in regard to shocks to welders. Regardless of special instructions, the whole philosophy of such a group of workers leads to a healthy respect for all electrical circuits and proper care in handling them.

The paramount warning should be to take particular care in hot and humid weather, and when welding in wet places. Almost without exception, fatal accidents to welders occur in hot weather. The operator's own condition and that of his clothing should be his guide. He should always guard against wet gloves, shoes, and clothing, particularly clothing made of thin cotton

The operator should assume the major responsibility for seeing that the insulation of the electrode holder is in good condition.

He should learn to carry an electrode holder by the handle, never slung over his shoulder, or squeezed under his arm.

He should never, under any circumstances, transport an electrode holder with an electrode or electrode stub in it.

He should never throw or lay an electrode holder down so that it makes contact with any conducting material.

He should never work alone in confined or concealed spaces where, for example, striking his head may cause temporary loss of his faculties.

He should be particularly careful when working above the ground or floor, since it is significant that many fatalities involve a fall.

This discussion can be summarized as follows:

1-Arc welding is not a hazardous occupation, as judged by industrial stand-

2-Electric shock is a relatively infrequent cause of death.

Where electrocution of the welding operator has occurred, one or more of three factors was usually involved:

- 1. An uninsulated electrode holder.
- 2. Wet gloves and clothing.
- 3. A fall.

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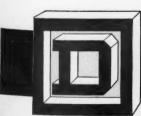
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